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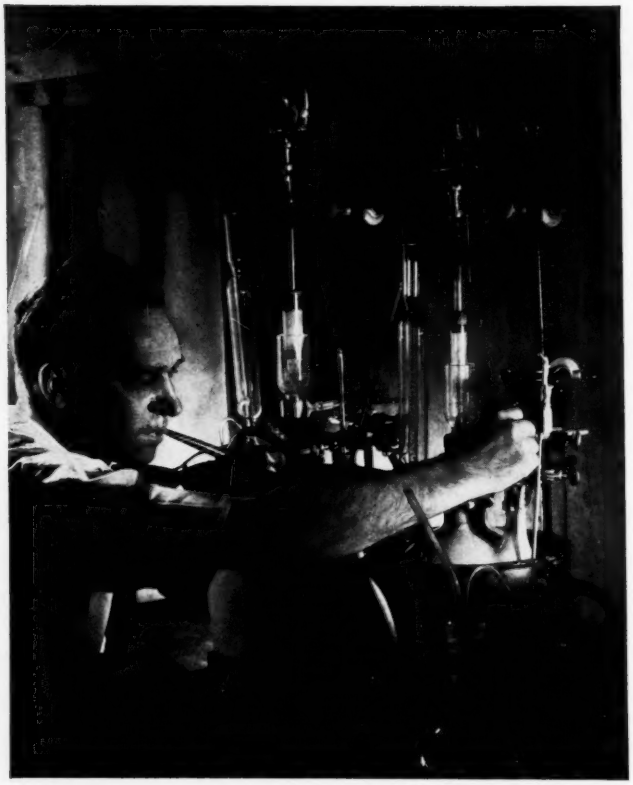

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OCTOBER 30, 1939

VOLUME 28 NUMBER 22

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TROUBLE SHOOTING ON A RUG

The rug one of our customers made to order for a large hotel was a thing of beauty—but a joy for only a short time. Unaccountably, the back cracked, releasing the pile in three distinct spots—and led to a demand for money-back from the hotel owner.

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For this helpful bit of sleuthing the rug maker was naturally grateful. So was the hotel man. Because one more hidden source of overhead had been uncovered, and could be guarded against in the future.

Naturally, trouble-shooting jobs like this come our way infrequently. But our ability to help in such cases is important to you. It shows that we at Calco have a practical knowledge of dyes, chemicals and related problems that makes Calco Dyes do a better-than-average job in your hands. This is one very practical reason why "Calco Dyes are Better Buys."

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AMERICAN
DYESTUFF REPORTER

VOLUME 28 OCTOBER 30, 1939 NUMBER 22

A Rapid Control Method for

Grease in Wool Scouring Liquors

JOSEPH W. CREELY and GEORGE C. LeCOMPTE*

WE have found it very helpful to have a rapid control method for grease in wool scouring liquors. The method described in this article has been in use for a period of four years and has proved its value as a control method.

The following tentative method was first adopted and checked in the following manner. The method consisted in shaking together 20 mls. each of scouring liquor, carbon tetrachloride and 95 per cent ethyl alcohol (Denatured Formula 3A is suitable) in a separatory funnel. After waiting for it to separate into two layers it is again briskly shaken and allowed to separate. 10 mls. of the bottom layer are collected in a graduated cylinder and transferred to a tared aluminum cup, evaporated on a steam plate under an air current and weighed. Wt. grease $\times$ 10 = per cent grease.

For the purpose of checking this method six artificial scouring liquors were prepared in the following manner: A known weight of recentrifuged anhydrous wool grease was weighed out in a 30 ml. beaker and 1 ml. of 10 per cent sodium carbonate and 1 ml. of 5 per cent sodium olive oil soap solutions were pipetted into it. The mixture was warmed and emulsified by stirring. 50 milligrams of Fuller's earth was added as an artificial soil. The mixture was washed into a separatory funnel with 18 mls. of distilled water. Two blanks, one to show the effect of leaving out detergents and Fuller's earth (sample 7) and the other including sodium carbonate but omitting soap and Fuller's earth (sample 8) are also listed in Table 1. The results obtained by extracting these mixtures with carbon tetrachloride according to the above tentative procedure are listed in Column 3.

If the results for per cent grease recovered in Column 5 are corrected by adding the mean error (approximately 7.7 per cent) or if they are multiplied by a factor 1.077, the corrected per cent error is found to be much smaller. This is tabulated in the last column.

The wool grease used in this work was previously purified by recentrifuging from an alkaline bath and drying. Laboratory tests failed to show any moisture in it whatever. Titration in alcohol to the phenolphthalein end point with n/10 sodium hydroxide required 0.68 mls. per gram of sample. This may be expressed as an acid value of 3.80 mg. of potassium hydroxide per gram of sample.

APPLICATION TO SCOURING LIQUORS

We have the choice of applying the tentative method as above described and multiplying the weight of grease obtained by 10.77 instead of 10, or we might alter the method so we can still obtain the per cent grease by multiplying the weight of grease by 10. We prefer to alter the method. This can be accomplished by using a 21.5 ml. sample given in the tentative method above. Results are then calculated by simply multiplying grams of grease found by 10 to get per cent grease.

We have found that considerable time can be saved by making a further change in the above procedure. If the scouring liquor, alcohol and carbon tetrachloride are thoroughly shaken and poured into a cone of a small centrifuge and then centrifuged for a minute or two a clear layer of carbon tetrachloride containing dissolved lanolin will be found at the bottom. 10 mls. of this layer can be pipetted off into a tared aluminum cup, evaporated and weighed. If the evaporation is done on an electric hot plate under a current of warm air the whole procedure can easily be completed in 15 minutes on most samples of scouring liquors. Results obtained with these changes made in the procedure check well with the results obtained using the tentative method and applying the correction.

PROPOSED METHOD

In view of the above recommended changes we would propose the following procedure as being rapid and reasonably accurate for the determination of grease in scouring liquors.

Measure out 21.5 mls. of scouring liquor, 20 mls. of carbon tetrachloride and 20 mls. of ethyl alcohol (Denatured Formula 3A is satisfactory) into a small Erlenmeyer flask and shake briskly for 30 seconds. Fill a 50 ml. centrifuge cone with the mixture and centrifuge it until sufficient clear layer has formed in the bottom of

*Eavenson & Levering Co.

TABLE NO. 1

Sample	Wt. Grease Added Grams	Wt. Grease Recovered Grams	Grease Added %	Grease Recovered %	Error %	Corrected Error %
1.	0.0498	0.0228	0.249	0.288	—9.2	—1.2
2.	0.1003	0.0457	0.501	0.457	—9.6	—1.8
3.	0.1498	0.0713	0.749	0.713	—5.0	+2.5
4.	0.1990	0.0942	0.990	0.942	—5.1	+2.5
5.	0.2990	0.1365	1.495	1.365	—9.5	—1.7
6.	0.3996	0.1851	1.998	1.851	—7.9	—0.2
7. (Blank)	0.1191	0.0589	0.595	0.589	..	..
8. *(Blank)	0.1262	0.0641	0.631	0.641	..	..
					mean % error =	—7.7

*No alcohol was used here. The alcohol was replaced by 20 mls. of water.

the tube. Pipette off 10 mls. of the clear layer into a tared aluminum cup. Evaporate to dryness on an electric hot plate under a current of warm air; cool by setting the cup on a large metal plate and weigh to the nearest milligram. Multiply the weight of the grease obtained by 10 to get the percentage of grease in the scouring liquor.

Fighting Ravages of

Moisture

JOHN E. HYLER

MOISTURE, both in the form of humidity and of actual liquid contact, continues to take a tremendous toll in causing various kinds of deterioration, though the detrimental effects caused by the presence of moisture are not so extensive as they formerly were, due largely to the better understanding of means and methods of avoiding such trouble and of counteracting it in one way and another. One of the first considerations in places where moisture arises in fog or vapor form is the possibility of its removal at the point where it arises, by using an exhausting system to carry it to the outside air. In such cases, there are always specific problems to be met, which vary as does the individual plant and location where the condition is found. Fans and duct work installed for the purpose of carrying away moisture vapor should naturally be made of some material that is itself highly resistant to moisture attack, or in other words, material that is corrosion resistant.

Moisture very often takes a decided toll at hidden points, and does very great damage before the condition is discovered. A case in point is found in boilers that are taken off the line for a time, possibly through the summer months, and to which no particular attention is paid with reference to internal moisture conditions. Care should be taken to allow for ventilation for such boilers, and in addition, many place some sort of material inside of them in pans or other containers, which has the effect of drawing all contained moisture to itself, such as lime.

One place where moisture often does very great damage, and yet the attack is entirely hidden, is on the surfaces of shafts of journals that are contained in bearings. Unless a bearing is properly sealed, moisture in the form of humidity or in some other form will often gain entrance, and will cause tiny bits of rust to gather on the shaft. This is especially the case with leaky bearings that fail to hold and to maintain an oil film of uniform nature on the shaft. Happily many of our more modern bearings are well enough designed and protected that a thing of this kind cannot readily occur. The problem has also been solved from another angle; that of using special lubricants which have a reaction with metals, and which by means of that reaction deposit on all wearing parts and surfaces a thin film which resists water to a high degree. Lubricants of this type have done much to reduce bearing maintenance in locations where moist conditions of necessity prevail.

There are of course various coating materials which are designed to protect against moisture on surfaces where they may be directly applied. Some of these are in the form of highly-efficient rubber-like or asphalt paints. Others have aluminum powder as their pigment, and this material acts like fish scales when it dries, lapping over to form very complete protection. Some of the more modern aluminum paints also are made with a special vehicle having high penetrating power. Entering deeply into the surface, it completely envelops rust particles already present, and fills all pores and pits so that no others may form.

In addition, there are special rust-proofing compounds that are colorless, and that are preferred by some where it is desired that a surface of metal be protected without

having the appearance of being painted. The same material, however, in other cases is used simply as a primer, and other paints are applied over the top of it.

Of especial interest in connection with protective coatings is the proposition of protecting coils, armatures or motor windings from moisture. Synthetic resin products of varnish type have been developed for this use that are so highly effective as to eliminate much of the trouble experienced in years gone by. The bad effect of moisture on coils and windings is so well known as to require little comment.

Sometimes there are cases where moisture can be very much reduced in a given location with a reasonable amount of attention to detail. One such case, where humidity is high in particular, has to do with moisture collecting on piping or other cool surfaces, and running or dripping. Proper insulation will more nearly equalize the temperature of such surfaces with the atmosphere, so they will not collect moisture. On the other hand, water may be directly escaping from a pipe joint in some cases, to cause trouble of one kind or another. The answer to this is to use a proper type of pipe joint compound when piping is being installed, and if need should be, to disassemble existing pipe lines in order that such breaks may be repaired. A little time lost in this manner will represent smaller loss than indefinitely enduring such a condition.

Most important of all, perhaps, in the never-ending battle against the ravages of moisture, is to keep ourselves fully advised as to the possibility of using materials and equipment that are inherently resistant to such damage, without any particular attention after installation. Stainless steel is one such item, for instance. Then there are certain forms of equipment which are less liable to damage under moist conditions. Consider, in the field of hoisting apparatus, for instance, the air hoist. This type of hoist is practically proof against dampness, and it matters not whether one is satisfied with a hoist having a 1,000 pound capacity, or whether one is needed that will lift ten tons, air hoists may be had that will do the job.

Moisture-proof materials, of course, include corrosion-resistant metals, and there are many different items and forms of material indeed in these modern days that may be had made of these materials. Machine rollers is a case in point. These rollers may now be obtained fully covered with corrosion-resistant metals, a factor which is going to have considerable influence in machine design in the future.

Plywood, for any plant or maintenance purpose, may now be had in a form that is highly moisture-resistant. The extent to which this is true may well be judged by the fact that plywood is now used extensively for lining concrete forms, and the same material can be used over and over again for holding wet cement and concrete, without any separation of the plies. Some of the plywood that is being made water proof is bonded with phenolic resin binders, such as are used in the plastics field. There is, in fact, a material offered to the machine builder and designer today by one of our outstanding manufacturers in the plastics field, which consists of wool laminations impregnated and bonded together with phenolic resins, and vulcanized into a hard sheet, which is highly resistant to moisture.

Even the plastics field purely considered as such, has refused to be left behind in this constant forward march against the ravages of moisture. There are now available special plastics which meet highly exacting specifications in this respect. Plastics that may remain immersed for years without swelling are now in use for special purposes, and will doubtless have consideration for use in many places on the moisture-battling front. It would be interesting if we could look ahead a few years to see what will be the state of affairs in this particular respect. One thing is certain. The man who makes the most of present methods available is going to make the fastest progress in a number of respects.

Rapid Extraction

for Mill Control

HERBERT C. HALLER*

THROUGH appreciation of results, laboratory control has proved its value many times. Today more than ever before there is a demand for closer vigil, which means the laboratory must be able to give not only rapid but accurate information. Armed with timely knowledge, adjustments can be made to overcome formidable difficulties. Such a control is exemplified in extraction.

Many mill men would like to have a greater number of extraction results to tie in with such work as scouring, stock oiling, grease pieces and clean cloth. The more information on hand the better analyses he can make of his own particular problems.

Some improvements for cutting down time involved have been offered and are worthwhile. The regular soxhlet method is undoubtedly the most accurate since fresh solvent washes oil and grease from the sample periodically.

*Chemist Continental Mills Inc., Philadelphia, Pa.

However, for rapidity the method is far from being the most efficient.

There are also smaller mills in which there is no established laboratory. To send samples out for analysis is not always satisfactory since often an "immediate" result is wanted. To get an answer after some types of work have been finished is not helpful. Sometimes it leads to conditions which can not be remedied. The expense of setting up the apparatus as described herein is rather small and can prove its value in a short time.

The outline given here runs somewhat parallel to the method described by Creeley[1] but the equipment and handling vary a little.

It is not intended that this method should replace the soxhlet extractions, especially where the extractable matter is very low. Here the advantage is speed with reasonable accuracy.

While the carbon tetrachloride gives slightly higher results its property of being non-combustible makes it a safer solvent. Then when a shrinkage is to be determined from the extractable matter, it is more important for the total shrink to be known. In other words, if only one type of grease is removed by a solvent and there is an appreciable amount of a fatty acid left behind with some mechanical dirt, the shrink figure would be inaccurate. Ultimately the fiber should be clean of all but a very small amount of extractable materials and fat oils, dirt and soap if not accounted for at first may give rise to troubles later.

APPARATUS

1—Drying oven
1—Balance and weights
1—Hot plate
1—Friederick's condenser
1—Special multi-connector*
Extraction flasks—300cc cap.
4—Tubes for leads to the connector
1—Support and clamp
Pint bottles—wide mouth
1—Desiccator
1—500 cc. graduate
Necessary rubber tubing and stoppers.

The number of flasks and bottles depend upon individual requirements. When set up the entire unit takes up very little space.

PROCEDURE

Representative samples of wool are taken and for each analysis 5 grams are used. Weight to the nearest 0.10 gram. The samples are transferred to the wide mouth bottles and 300cc of solvent are added. The bottles are closed with corks and then shaken by hand. About 15 shakes every few minutes for about 15-20 minutes is sufficient. This is followed by taking a 250cc aliquot and pouring into the extraction flask. With the aid of the

This photograph shows the compactness of the distilling unit.

multi-connector between the flasks and condenser 4 samples can be distilled simultaneously. This operation takes approximately 15 minutes. As the flasks loose solvent one may be finished before the others. If there are additional distillations to follow a rapid exchange of the flasks is made. Otherwise, the unoccupied opening may be closed with a cork. The distillation is carried down to a point where the bubbling ceases but not to a point where the grease starts to burn. On removing the flask it is tipped on its side to allow the remaining hot carbon tetrachloride vapors to flow out. The vapors being much heavier than air, this can be done. With a little experience one can expel all the remaining solvents. Care, of course, must be exercised not to allow any of the oil to run out. The flask is then oven-dried and desiccated before weighing. One user of this method has found that by carefully distilling and then pouring out the fumes, that the oven drying could be dispensed with. A number of checks had been made to prove this point and the results were very gratifying.

The weight of the flask plus grease minus the original flask weight gives the amount of grease in 250cc.

Then:

$$\text{Wgt. of grease} \times 24 = \%$$

Since

$$\dagger\ 24 = \frac{(300}{(250} \times \frac{1}{5} \times \frac{)}{100)}$$

With the method described it is not uncommon to finish as many as 50 samples per day, per unit, with ease.

Individual requirements may call for other solvents or perhaps even better accuracy. As outlined here it is primarily meant for mill processing control where extreme accuracy is not needed, but where rapid workable answers are necessary.

†It should be noted that this formula is only applicable when a 5 gram sample is used.

[1]A. J. Creeley—A Rapid Method for Determining Grease in Scoured Wools, American Dyestuff Reporter, 5-3-39.
*Obtainable from Arthur H. Thomas, Philadelphia, Pa.

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• CALENDAR •
OF COMING EVENTS

Fall Meeting, South Central Section, Andrew Johnson Hotel, Knoxville, Tenn., December 9, 1939.
(This is the date of the Auburn-Tennessee football game.)

Annual Meeting and Convention, auspices New York Section, 1940. Date to be announced later.

Microscopic Observations of Wool Dyeing*

H. E. MILLSON, G. L. ROYER and M. E. WISSEMANN**

WOOL is a natural animal product and because of its heterogeneous nature presents many problems to the dyer. During its growth it has been exposed to weather of all kinds; strong sunlight, extreme heat, cold, and a host of other conditions which have a definite effect upon the wool hairs. In addition, when we consider that a blend of wool may contain several stocks, each raised in a different section of the country, or even the world, it is easy to understand why the dyeing and processing of wool has its attendant problems. In trying to understand and overcome some of these conditions the textile chemist is now employing all of the tools known to modern science. The main purpose of this paper is to show some of the results we have obtained by using the microscope and color photography.

NOTE—The presentation of this paper at the Boston meeting of the A. A. T. C. C. was illustrated with about sixty colored slides taken by the Kodachrome Process. In this publication a few of these are reproduced in black and white to help with the explanation of the phenomena discussed.—ED.

The Blending of Wool

Microscopic examination of the cross-sections of various types and sizes of wools made by the Hardy[1] method shows a great variation in fiber structure, especially in the lower grades. For example, Fig. 1 is a high quality carpet wool and is quite uniform. The white Mongolian shown in Fig. 2 is composed of various sizes and types of fibers and it can be seen that some are medulated while some of them have collapsed. Fig. 3 shows a low grade wool composed of white and natural colored fibers. These are only a few of the variations which are found in natural wool. In the blending of wool many types and qualities are mixed and these blends of fibers, having different properties, add to the difficulties of the dyer during the dyeing of wool.

Fiber Selectivity

Some dyes such as Calcocid Orange Y (Fig. 4) will penetrate and dye most fibers uniformly, giving a solid pattern when cross-sectioned. Many other acid dyes, such as Amaranth (Fig. 5), and most milling colors (Fig. 6) show fiber selectivity to a greater or lesser extent. Cross-sections of such dyeings frequently show all or some of the following effects: (a) fibers which have not taken any dye; (b) fibers which are partially dyed; (c) fibers which are light in shade, but dyed completely; (d) fibers which are dyed heavy and completely.

Experiments with many acid dyes have shown that fibers exposed to sunlight, ultra-violet light, and weather will generally dye heavier with colors that show fiber

*Presented at Annual Meeting, Boston, Mass., September 16, 1939.

**The Calco Chemical Co., Bound Brook, N. J.

[1]U. S. Dept. of Agriculture, Circular 378.

Fig. 1 Mag. 125x

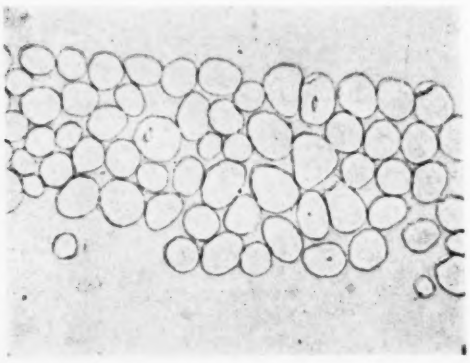
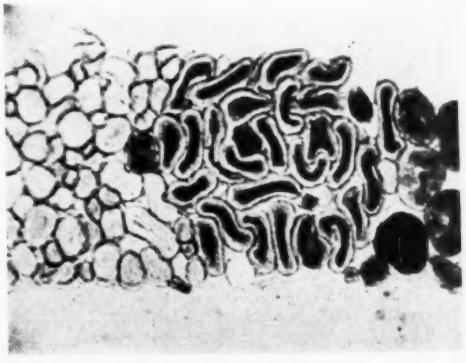


Fig. 2 Mag. 125x

Fig. 3 Mag. 125x



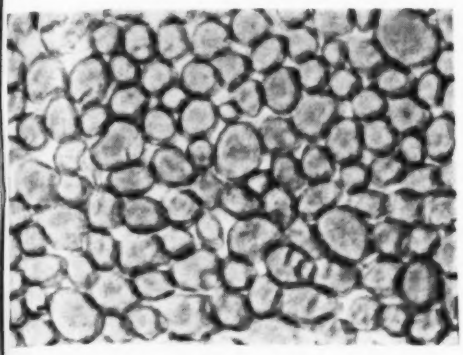


Fig. 4
Mag. 250x

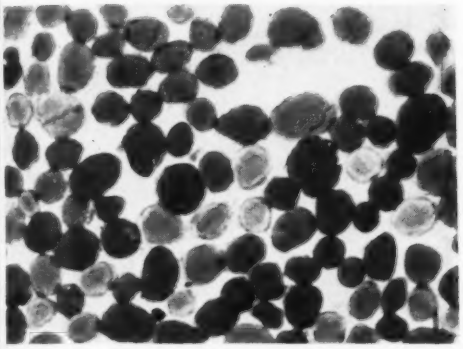


Fig. 5
Mag. 250x

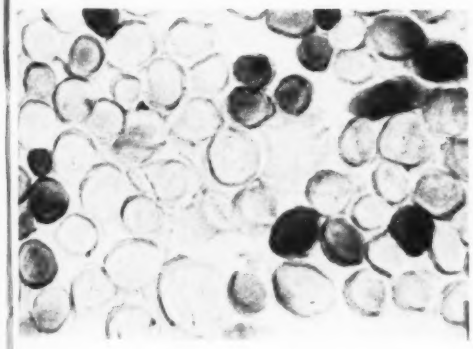


Fig. 6
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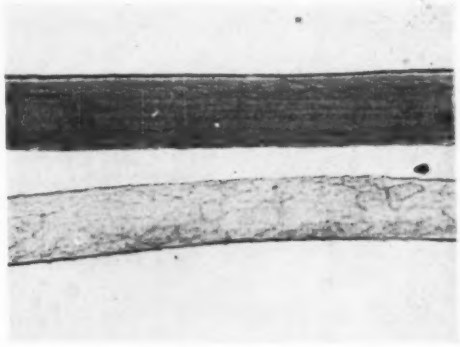

Fig. 7
Mag. 250x

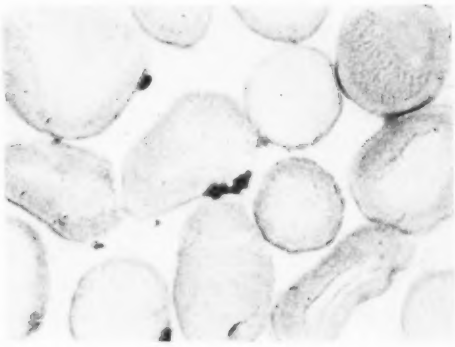

Fig. 8
Mag. 250x

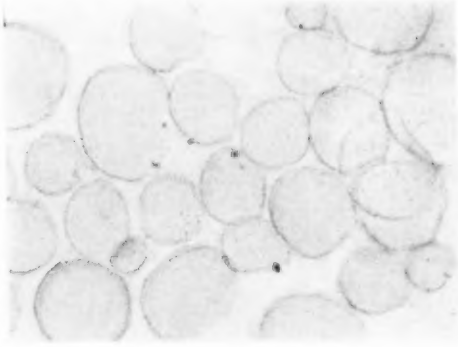

Fig. 9
Mag. 250x

selectivity and absorb dye more readily than unexposed fibers. It has been stated that exposure to light causes some of the sulfur in the wool fibers to change to hydrogen sulfide and the fibers suffer a loss of scales, apparently in proportion to the amount of damage suffered. These exposed and damaged fibers swell to a greater extent than an undamaged fiber and have a changed affinity for dyes.

When fleece, as sheared from the sheep, is dyed with a fast to milling orange, that is known to show fiber selectivity, sometimes referred to as a positive effect, under such conditions that the fibers remain in the same relative positions during the dyeing, the result is a dyeing with the ends colored much more heavily than the portion cut from the body. This has been called "tippy dyeing."[2]

[2]W. Von Bergen, Mel. Textil. Ber., 1923.

Microscopic comparisons of the tip and body ends of such fibers by both longitudinal (Fig. 7) and cross-sectional views (Figs. 8 and 9) shows the marked difference in both the structure of the fiber and the manner in which the dye has penetrated. These show that the dye has penetrated the tip ends (Fig. 8) while the body ends (Fig. 9) have practically no dye absorption. When the fleece is carded and spun there will, of course, be a random distribution of body and tip ends throughout the yarn.

In order to prove that exposure to light is a factor in causing fiber selectivity, French spun yarn, both exposed and unexposed to light was dyed with Calcocid Orange Y and a milling fast orange. In the case of the Calcocid Orange Y no color contrast of the individual fibers was observed. The milling fast orange dyeings of the un-

exposed yarn showed, however, marked shade contrast, while the exposed yarn gave a result as solid in appearance as that of Calcocid Orange Y. In many cases this fiber selectivity, which is so apparent when viewed under the microscope, detracts from the appearance of the finished product, by giving a heathery or skittery appearance instead of a solid, uniform shade. Compound shades which have been produced with two or more ordinary acid dyes, each of which has fiber selective properties, will, as a general rule, give heathery results. If a seal brown shade is made with an orange that colors all fibers uniformly and a red and blue which are fiber selective, the seal brown may match the shade desired but close examination will show that the orange will have dyed the fibers which have resisted the blue and red giving a seal brown shade interspersed with orange fibers. In these circumstances, it is wise to examine the shade during the first hour of boiling for this condition and if it is found to exist, measures should be taken to correct it. Two methods are suggested for its correction, namely: (1) to feed on small amounts of dyes which completely cover all fibers; or (2) to add more acid and prolong the boiling period.

Another condition which we have observed is the effect of feeding colors on at the boil in order to match a given shade. Practically every dyer has had the experience of having to make several additions of dye in order to bring the lot to shade. If the original amount of dye, plus the feeds are added at the start on the next lot to be dyed, the shade often comes up too heavy, even though the yarn or cloth, machine, acid, Glauber's salt and other conditions remain the same. Numerous experiments have indicated that dyes which are added toward the end of the dyeing period do not produce exactly the same effect, as when they are added at the beginning. Microscopic examination of cross-sections of the finished shades produced by adding the dyes in different orders, shows that the majority of the fibers are dyed the shade of the dyes added at the beginning. The dye or dyes which are added at the end penetrate readily into those fibers which are most easily dyed, the short period of boiling after the dye has been fed on not being long enough for the dye to equalize by transferring to the more resistant fibers.

These experiments lead to the view that the structure of the surface of the fiber is a major factor controlling the rate of penetration of the dye. Further confirmation was afforded by dyeing experiments under the microscope on short fibers. These experiments also showed that the penetration of the dye through the cut ends of the fibers was always rapid (Fig. 10), while the penetration through the sides was invariably very slow except for those fibers whose external structure has been altered or mechanically damaged (Fig. 11).

It has been found possible to differentiate, by using the ultra-violet microscope, between fibers damaged naturally and those which are undamaged. The former shows marked fluorescence, the latter little or none. Fibers separated by this method were used for experimental purposes and dyed under the microscope with dyes which show definite fiber selectivity. Those fibers which fluoresced and were assumed to have been damaged, dyed readily, while those which were undamaged in most cases remained undyed (Fig. 12).

Effect of Strong Sulfuric Acid on Wool Hairs

The difference between the damaged and undamaged hairs is readily shown by observing the decomposition of selected wool hairs when they are treated with concentrated sulfuric acid. The sulfuric acid penetrates the damaged fiber more readily than the undamaged. Furthermore, the scale structure on the undamaged fiber is usually quite distinct, does not slough off, and opens up with difficulty.

Comparative Leveling Rates

It has been helpful to study the penetration of dyes into the individual hairs as it is related to the leveling of a dye during the dyeing process. Samples were removed at definite time intervals

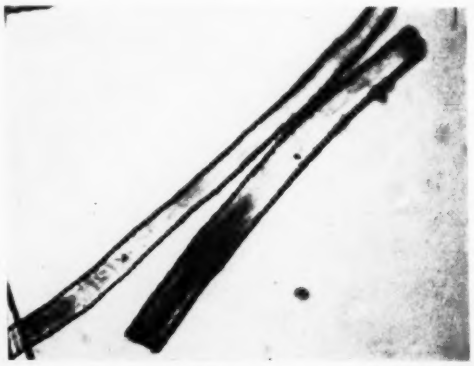

Fig. 11
Mag. 125x

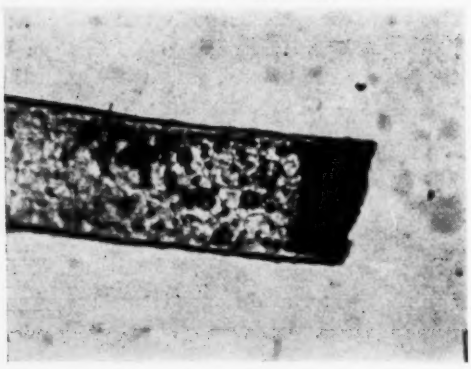

Fig. 10
Mag. 125x

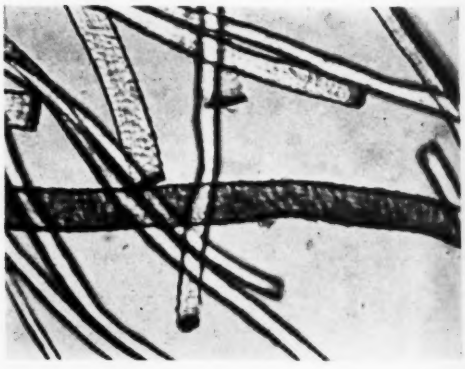

Fig. 12
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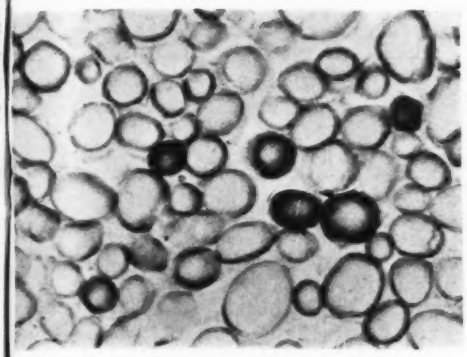

Fig. 13
Mag. 250x

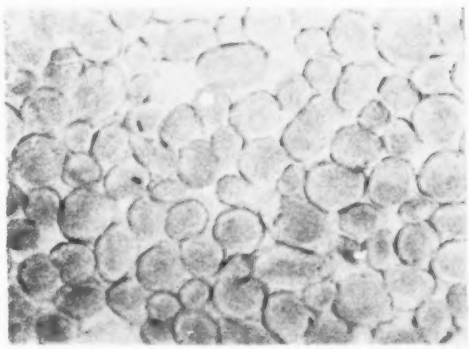

Fig. 14
Mag. 250x

from dyeings made with several representative wool dyes. Calcocid Alizarine Blue SKY is an example of a dye which is uneven at the early stages of the dyeing operation (Fig. 13), but which evens out as boiling is continued (Fig. 14). In contrast to this, a milling fast orange starts out uneven (Fig. 15) and does not completely even out during the same time period (Fig. 16). Our experiments have shown that the leveling of dyes varies greatly over different time cycles. A dye such as Calcocid Orange Y may be level and well penetrated on 15 min. boiling, while other dyes must be boiled 6 or even 12 hours to equal the levelness obtained with Calcocid Orange Y in 15 min.

Apparently, many widely different factors influence the leveling of a dye. Solubility of the dye and type of aqueous solution it gives (i.e., colloidal, large particles and aggregates or small particles and true solution) is of paramount importance. The qualities and types of stock in a blend to some extent govern the solidity of shade, while the operations previous to dyeing, such as scouring, carbonizing, chlorination, etc., not only exert an influence, but sometimes change completely, the affinity of the fiber for dyes. If we dye a skein of worsted with a milling fast orange and examine the finished dyeing under the microscope, we will see many white undyed fibers. When this same orange skein is redyed with a level dyeing dye such as Calcocid Green CR, we find on examining the cross-section again that all of the fibers which had resisted the milling fast orange and had remained white, are now colored green and the fibers which had taken the orange dye have also been colored by the green giving a shade similar to a combination of green and orange. This proves that although some fibers are entirely resistant to certain types of dyes during a normal dyeing time cycle, these same fibers can be dyed and penetrated in a very short period of time with a different type of dye.

Chrome Dyeing

Cross-sectional studies have been made on samples obtained by the various methods commonly used for the dyeing of chrome colors. It has been found that in most cases the original unchromed dyeings showed good fiber penetration and solidity of color.

When the fiber had been pre-treated with chrome (Bottom Chrome method), the penetration of the dyestuff was found to be somewhat hindered with the result that fiber selectivity and ring dyeing effects were apparent. When dyeings were made by the Meta Chrome method the resulting color formed during the dyeing operation did not penetrate into the fibers and gave, as a result, a dyeing similar in cross-sectional appearance to that obtained by the Bottom Chrome method. In the case of the Top Chrome method, the initial dyeing was similar to that of any acid color, that is, little or no fiber selectivity was evident. The subsequent chroming appeared to be merely a matter of forming the chromium product of the dyestuff within the fibers themselves, but was not accompanied by any change in the distribution of the dye within the wool hairs. These observations give an explanation for

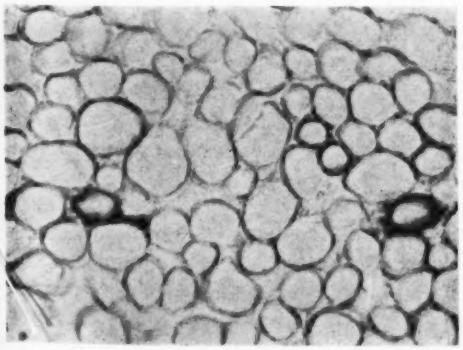

Fig. 15
Mag. 250x

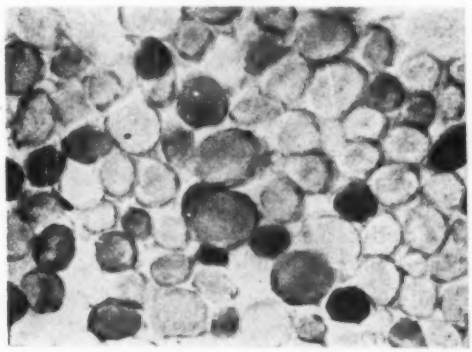

Fig. 16
Mag. 250x

some of the variations in shade which are obtained with the same dye when dyed by the three different chrome processes.

Ultra-Violet Microscopic Examinations

Studies were made of fluorescent dyes with the ultra-violet microscope in order to learn more about the phenomena of dye penetration. Brilliant Sulfo Flavine FF was found to be a level dyeing dye with no fiber selectivity. Sulfo Rhodamine BG, on the other hand, shows not only fiber selectivity, but also non-uniformity of penetration within the same hair. Combination shades of these two dyes gave some striking effects. In visible light an indication of these effects could be seen, but they were not as pronounced as when viewed in the ultra-violet.

The use of fluorescence in microscopic studies is an advantage because small amounts of the fluorescent dyes are easily visible in ultra-violet light. This makes it possible to trace the presence of very small quantities of fluorescent dyes and determine their location within the wool hairs. The fluorescent method is also sometimes helpful in determining the composition of unknown complex shades. If fluorescent dyes are present their identity is quickly revealed by their characteristic fluorescence.

When cross-sections of combination dyeings made with the above two dyes were examined with the ultra-violet microscope, it was found that frequently individual fibers were apparently dyed only with the color which possessed no Fiber Selectivity. The remaining fibers exhibited a gradation of shade which ranged from green to orange, probably due to the different rates of penetration of the two dyes through the various portions of the individual fibers.

The Effect of Moisture on Shade

The shade of a finished dyeing in many cases is affected by the amount of moisture remaining in the wool, as previously described by Millson and Wall[3]. This is an important factor often overlooked in the matching of processed samples with the customer's sample. The difference between a moist and dry sample is readily shown with dyeings of Calcocid Green S Conc., the dyeings being much lighter when they are moist than when dry. Cross-sections of entirely dehydrated dyeings show an increased color intensity within the fiber. As no apparent change in the location of the dye within the fiber is visible, it is probable that the color change is due to dehydration of the dye itself. Since wool is more hygroscopic than any of the other common textile fibers and under average conditions often contains twelve to fourteen per cent of absorbed moisture, it is important to keep this fact in mind when matching a sample.

Redyeing

Microscopic examination of redyed wool shows some marked effects. In examining commercial samples of redyed blacks, it has been found that when they have been redyed with the Sulphon Cyanine or Chrome Blacks, solid fiber patterns are not obtained. A cross-section of a 2 per cent dyeing of a chrome red redyed with 6 per cent of an acid black shows that all of the fibers have been covered by the redyeing. In contrast to this, when the same red is redyed with 6 per cent of Sulphon Cyanine Black, it is found that some of the red fibers are not thoroughly redyed by the black, in that the black has not penetrated very far into the individual fibers. The difference in the two redyeings is explained by the different penetration rates of the two blacks into various types of fibers which are present in the wool blend.

Many times when redyeing shades such as dark greens, reds, yellows, etc., into black, the finished shade has the overtone of the original shade. Our observations would lead us to conclude that this is caused by the presence of fibers which have not taken the black, therefore, in redyeing, it is always best to include in the formula, whenever possible, a dye which does not show fiber selectivity.

Dyeing at Low Temperatures

Much interest has been shown recently in methods for dyeing wool at lower temperatures. Cross-sections of dyeings made under these conditions show that even in the case of Calcocid Orange Y, the penetration is poor. The individual fibers are only partially penetrated, hence, exhibit a ring of color with the center of the fiber undyed. In our opinion, therefore, further work is necessary before low temperature dyeing of wool will give equivalent results to present methods.

Mildew

It is a well known fact that wool, if not properly stored, is liable to become mildewed. This mildew is a fungus growth which, according to Matthews[4], attacks the scales on the surface of the wool fiber and then eats into the inner substance of the wool.

Recently we have had the privilege of photographing under ultra-violet light and in color, a series of mildewed wools furnished us by Dr. W. von Bergen. Because mildewed wool fluoresces brilliantly in ultra-violet this is a means of ready identification, a fact substantiated by examining the above specimens.

If the mildew is fresh and the wool is damp, its presence may be detected by its characteristic musty odor, but if it has dried out detection becomes more difficult.

In practice it is often necessary to determine whether brownish stains in yarns or pieces are due to mildew or iron. If such stains are examined under ultra-violet light the difference between them is easily apparent. Mildew growths are brilliantly fluorescent while iron stains remain dark.

Commercial Dyeing

Microscopic cross-sections have been made of a large number of commercial dyeings. It has been noted that in most cases the penetration is not as good as in the case

[3]Textile Colorist *59*, 29 and 120 (1938)).

[4]Textile Fibers, by J. M. Mathews, Griffen & Co., England.

of laboratory dyeings of the same colors. This is probably caused by differences in dyeing conditions, for example, in many cases it is not possible to obtain as vigorous boiling and agitation in the handling of large quantities of goods in the plant as can be obtained in the laboratory with smaller quantities.

In practically all commercial dyeings the formulae call for a number of dyestuffs, each having different dyeing characteristics. Although the microscopic examination may reveal fiber selectivity in some cases, generally the appearance to the eye will be commercially satisfactory.

To the dyer the close examination of the microscope many times is too critical for use in judging level dyeing. The microscope does, however, afford a means of following and explaining the action of certain dyes when used alone and also their peculiarities when combined with other dyestuffs. Properly used, microscopic investigations should be of assistance in substantially improving wool dyeing and have already revealed many facts that would otherwise have escaped attention.

The authors wish to thank Mr. W. H. Watkins for the preparation of the samples used in a portion of this investigation. The cooperation of other members of our Research and Technical Laboratories is appreciated.

DISCUSSION

President Eavenson: Did you ever do any quantitative work on the determination of degradation of wool?

Mr. Millson: There are several chemical methods that are in use for that purpose, but since it is very difficult to obtain reproducible results with some of the chemical means, we have felt that the cross-sectioning and the examination under the microscope has been a definite lead, at least, to the trouble. Then to back it up the chemical analysis and other chemical tests give a second check upon your examination with the microscope.

President Eavenson: Do you use the steel plate method for cross-sectioning?

Mr. Millson: Yes, the Hardy microtome method. Those cross-sections that you have seen are between ten and sixteen microns thick so that sometimes in a cross-section you are very much surprised by the lack of depth of color in the sections as thin as that. It is natural that some of the light will pass through and make your shade very much lighter than it appears when you hold it in your hand in the form of a skein or piece of stock.

President Eavenson: Did you ever do any quantitative work for the determination of the dye remaining in exhausted dye baths?

Mr. Millson: Yes, sir. we have done some work along that line. With reference to exact determinations we don't feel that the results are always as accurate as they might be. Many factors influence the results such as, dyeing under exactly the same conditions each time, longer boiling time, more vigorous boiling, greater or lesser exhaustion of the liquor changing the ratio of liquor to yarn by evaporation of the dye bath, etc. All these things would influence the results of the titrations. With all these possible variations your titrations are not accurate and cannot be reproduced from time to time.

Mr. Healy: How large a sample do you dye to get these samples for microscopic examination?

Mr. Millson: Anywhere from five to twenty grams, depending on the quality of the wool and type of dyeing. We try to keep our liquor and acid at exactly the same ratio as when starting out, so that we have as uniform and reproducible results at the end as is possible to obtain.

Mr. Christison: Have you made any study of the effect of Glauber's salt on the absorption of the dyes?

Mr. Millson: Yes, sir, we have, but not as much as the English have recently, as demonstrated in that article they published. Apparently the effect of Glauber's salt is determined to some extent by the alkalinity of the original wool when the dyeing was started.

Does that answer your question, sir?

Mr. Christison: Well, not exactly, because if you made up a dye bath that contained the acid and Glauber's salt do you still think that the previous condition of the wool would have some influence?

Mr. Millson: No, not in a strongly acid bath. I wouldn't think so. In that case the Glauber's salt appears to help level and retards the action of the acid to some extent. When we have made dyeings with and without Glauber's salt it appears that the dye bath usually exhausts a little better without the presence of Glauber's salt than it does with the presence of Glauber's salt.

Mr. Christison: Again, does the Glauber salt help in the penetration of the dye into the fiber?

Mr. Millson: My answer would have to be modified somewhat. It is very hard for us to tell whether the presence of the Glauber's salt holds back the action of the dye on some of these fibers which normally would take the dye very heavily right at the beginning until the other fibers have had a chance to catch up. That is something we haven't been able prove definitely one way or another.

I think that it does enter into the problems to some extent.

Have you any suggestions as to the effect of Glauber's salt? You might be able to make some suggestions that would help us.

Mr. Christison: No, except that we all know from experience that we get a more level appearance and less, what you call, skittery dyeing in the presence of Glauber's salt than we do without it.

Mr. Millson: Yes, sir, that is true.

Mr. Christison: And we do know that there is apparently more surface action without the Glauber's salt than with it.

Mr. Millson: That is right. In the metalized types of

dyes I don't believe the addition of Glauber's salt helps one way or another. We have tried it with and without, and have cross-sectioned these, but have not been able to see any definite improvement in the metalized types of dyes such as the Neolans and Palatines.

Mr. Christison: I think that is borne out in practice, too.

Mr. Millson: I think so, yes.

Mr. Schmitt: I was interested in your slides showing the selectivity of chrome dyestuffs, dyed acid, chromate, top chromed and chrome mordant. How were your metachrome dyeings made? Were they neutral metachrome or acid?

Mr. Millson: We have made dyeings by all of the various methods. This one here was the potassium dichromate or sodium dichromate and ammonium sulfate topped with acetic acid.

Mr. Schmitt: You haven't made any slides, then, where it was dyed absolutely neutral?

Mr. Millson: You mean sweet chromed, in other words, just ordinary chromate or dichromate?

Mr. Schmitt: Neutral chromate of potash and ammonium sulfate and no acid.

Mr. Millson: Yes, we have made quite a number of them.

Mr. Schmitt: Did you notice that the fibers dyed more uniformly?

Mr. Millson: In some cases they seemed to, while the addition of acid seemed to build up the shade considerably and make a heavier dyeing.

Wool Dyeing Phenomena*

R. H. KIENLE and G. L. ROYER**

THROUGH the medium of color motion photomicrography, an attempt has been made to present many of the phenomena discussed and shown in a companion paper†. In the first few scenes of the motion picture, the laboratory preparation of a dye is demonstrated, followed by the preparation of a dye under the microscope. The remainder of the moving picture shows a number of microscopic observations we have made in our study of wool dyeing.

It is not possible in this short paper to discuss completely the technical set-up used to take these colored microscopic moving pictures. However, the pertinent details will be described. Fig. 1 shows the assembled apparatus. A Spencer micro-movie attachment combined with a Bell and Howell 16 mm. "Filmo" camera was used. Focusing during exposure was accomplished by the combination of the Spencer movie attachment and the Leitz "Micro Ibso" partially reflecting prism arrangement. The correct exposure, which is so necessary for color photography, was determined by a specially designed photocell exposure meter, the photocell for which was located on top of the "Micro Ibso" attachment.

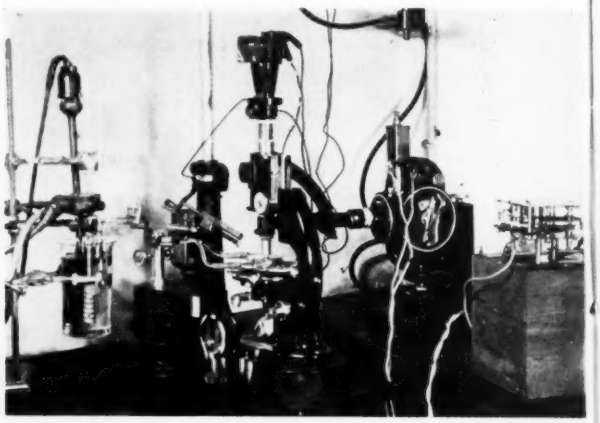

Fig. 1

In the individual fiber dyeings which were photographed, it was necessary to carry out the operations at a temperature near the boiling point. To accomplish this, a hot stage was used which could be heated by a circulating liquid to any desired temperature. Even at these elevated temperatures it was found that the dyeing of wool was too slow to record at the normal rates of exposure, so the speed was increased. This was done by the time lapse method to give fast motion pictures (opposite to slow motion, which is well known for slowing down action for viewing). An electrical timing device was used to take one picture every 2 seconds, so that when this was projected at the normal rate, the action was speeded up about thirty times. Other speeds could be obtained by changing the time lapse between exposures.

Kodachrome Type A 16 mm. film was used, and the tungsten projection lamp was corrected with a Wratten 78B filter so that its color would be satisfactory for the

*Presented at Annual Meeting, Boston, Mass., Sept. 16, 1939.

**The Calco Chemical Company, Inc., Bound Brook, N. J.

†*Microscopic Observations of Wool Dyeing*, by H. E. Millson, G. L. Royer, M. E. Wissemann, appears in this issue.

color sensitivity of this type of film. With this set-up, it is possible to record, in color motion pictures, phenomena which can be seen through the microscope while simultaneous observation and exposure corrections are being made. The colors produced by color photography may not in all cases be true reproduction, but the results are very much more satisfactory than black and white for the recording of subjects which show color.

An outline of the moving picture is as follows:

I.—Laboratory Preparation of a Wool Dye.

II.—Preparation of Orange Y Under the Microscope.

A. Crystals of Sulfanilic Acid.

B. Crystals of the Diazo of Sulfanilic Acid.

C. Reaction with Beta Naphthol to form the dye Orange Y.

III.—Some Crystallized Wool Dyestuffs.

IV.—Microscopic Studies of Wool Dyeing.

A. Dyeing two types of selected wool hairs.

(1) Dyeing of two selected wool hairs with a dyestuff which dyes both hairs readily.

(2) Another portion of the same two hairs dyed with a dyestuff which tends to be selective in its adsorption.

(3) Another portion of the same two hairs exposed to light and dyed with the same dyestuff which showed selectivity in the previous picture.

B. Dyeing the ends of the same hair.

(1) The tip and body ends of the same hair being dyed with a dyestuff which dyes both readily.

(2) A similar hair dyed with a dyestuff which tends to be selective in its adsorption.

C. A strongly selective dyestuff dyeing a mixture of short length wool hairs showing uniform penetration through the ends.

D. Dyeing with Orange Y.

(1) Wool dyed with Orange Y, 30 times normal rate.

(2) Casein wool dyed under same conditions, 15 times normal rate.

E. Dyeing with Naphthol Green B.

(1) Wool dyed with Naphthol Green B, 30 times normal rate.

(2) Casein wool dyed under same conditions, 15 times normal rate.

F. Dyeing with Naphthalene Green V.

(1) Wool dyed with Naphthalene Green V, 30 times normal rate.

(2) Casein wool dyed under same conditions, 15 times normal rate.

G. Dyeing with a Milling Fast Orange.

(1) Wool dyed with a Milling Fast Orange in acid solution, 30 times normal rate.

(2) Casein wool dyed under same conditions, 15 times normal rate.

V.—Decomposition of Fibers With Sulfuric Acid.

A. Reaction of strong sulfuric acid on dyed wool.

B. Reaction of strong sulfuric acid on dyed casein wool.

VI.—Crystalline Azobenzene in Polarized Light.

Friday Evening Session

Nineteenth Annual Meeting

September 15, 1939 ***Boston, Mass.***

THE session convened at eight o'clock, Clarence L. Nutting, Chairman of the Northern New England Section, presiding.

WELCOME BY CHAIRMAN NUTTING

Chairman Nutting: Ladies and Gentlemen: I observed in some of the advance notices of this session in the DYESTUFF REPORTER that you don't know beans until you come to Boston. Judging from the tables as I have seen them this evening with the bean pots, you must all know your beans by this time.

I find myself in somewhat the same predicament that the new groom did directly after his wedding ceremony had been performed. At that time the friends of the bridegroom very earnestly called upon him for a speech. He tried to decline as nobly as he could, but they insisted that he give them a speech.

He was very much embarrassed as he stood beside his new bride, but still his friends persisted and even lifted him up into a chair at the side of his new bride. In his embarrassment he placed his hand very affectionately on the shoulder of his bride and said, "Ladies and Gentlemen, you have thrust this thing upon me."

That is the position I find myself in now. However, as Chairman of the Northern New England Section, it is my happy privilege to extend to you personally, and on behalf of the Section, a most sincere and earnest welcome, and I trust that when you leave this Nineteenth Annual Meeting you will go home with the feeling that the convention in Boston has been a very happy and profitable one.

We have a rather lengthy program tonight preceded by which we will have a short business meeting. At this time I am going to turn the meeting over to our President, Mr. Eavenson, so that he may conduct that business session.

Mr. Eavenson! (Applause)

BUSINESS SESSION

President Eavenson: I know you are all looking forward to this Annual Meeting with a great deal of pleasure. It has been customary to hold the meeting at the end of the year. At that time our fiscal reports are ready and the election of officers is to be announced, but we are here now at an earlier date.

The Treasurer's report, I believe, will be published in due form in the DYESTUFF REPORTER. The same applies to the Secretary's report.

Personally, I know nothing of importance to come before this meeting. It may be that our Secretary has something. May I call upon Dr. Chapin?

Secretary Chapin: I am simply asking permission to file my report for publication. Mr. Moorhouse has asked the same.

I think there is no other business.

President Eavenson: That may be granted without a motion.

I would like to know if anyone from the floor has anything to present to this meeting.

If not, I would entertain a motion to adjourn.

Mr. Killheffer: I so move.

. . . The motion was duly seconded . . .

President Eavenson: It has been moved and seconded that the business meeting adjourn. All those in favor will signify by saying, "Aye"; opposed, "No."

Chairman Nutting: Ladies and Gentlemen: I am very happy at this time to be able to present to you His Honor, Maurice J. Tobin, Mayor of the City of Boston.

Mr. Tobin! (The audience arose and applauded)

WELCOME BY MAYOR TOBIN

Honorable Maurice J. Tobin: Mr. Toastmaster, Officers, Members of the American Association of Textile Chemists and Colorists: I appreciate that it is never in order to make an extended talk when a group is going to see a very fine show. I have seen evidences of that good show on the outside, and I am going to be very brief.

It doesn't seem out of order for me to welcome you here, because really you had your birth here in Boston. The gentleman seated at the extreme left end of the table was the sparkplug behind this organization away back in 1920. It was more or less of an infant organization, if I can judge by the kind of clothes I had to wear back in the war days.

I remember that before America got into the war I went to a Harvard-Yale game in 1916. I was quite a youngster at the time. I wore my first long pants suit. It rained a bit that day and I had the dye clean through every stitch of clothes that was on me. The suit might have been a little old. It was probably dyed with 1915 dyestuffs before you boys got together and developed the marvelous products that we have in practically all American clothes today.

When we consider that away back in 1914 there wasn't a textile institution in New England or the rest of the country that wasn't worried to death about what they were going to do unless everybody appeared in the undyed fiber as it appeared after it came off the spinning wheels, and when we consider that we were producing only two per cent of the dyes and that today over ninety per cent of the dyes used in America are produced in America, a world war certainly has no fears for you gentlemen.

I could go on regarding the contribution that chemists have made to make America a self-sustaining nation in the event, God forbid, we should become involved in a conflict similar to the one we were involved in in 1918, a conflict that may have even greater disaster to America because despite our Siegfried Line on one side and the Maginot Line on the other, namely, the Atlantic and Pacific, we may get into trouble. I seriously doubt it. But I think as a result of the ability of the chemists of America the few products that America lacks in a natural way today will be furnished by the men of your profession.

I would like very much to talk to you—I have a great many things I would like to say to you—but it is entirely out of order to break into the midst of an entertainment program. But I am delighted to welcome you here in behalf of the citizens of the city and to say to you that it is merely a homecoming because your first convention was held in Boston in the year 1920. I trust that you will come back here regularly. We would be delighted to have you every year for your national convention.

May the deliberations of the organization result in a great fund of knowledge for every delegate present, and as a result of it, may all America benefit by your deliberations and the chemists of America continue to make that contribution that makes America what I consider it to be today, the one impregnable nation in the whole of the civilized world.

Thank you very much. (Applause)

Chairman Nutting: We certainly all appreciate the words of welcome and encouragement from the Mayor of the City of Boston. We hope that when we meet again in Boston we may enjoy the privilege of hearing Mr. Tobin again as the Mayor of Boston. (Applause)

We will now turn the program over to Mr. Lane that we may proceed with the entertainment.

. . . A program of entertainment was then presented . . .

The Present Status of Casein Fiber*

E. O. WHITTIER and S. P. GOULD**

THE development of the manufacture and use of casein fiber in Europe in the past five years is somewhat analogous to the earlier stages of the development of rayon. It is not necessary to discuss here the reasons why it was desirable to develop an artificial silk, why cellulose rather than a protein was used as the raw material, what were the earlier short-comings of rayon, how several different processes have competed for supremacy, and how rayon came to its own unique position among textile fibers. The answers to these questions are familiar to you and suggest what is happening and may happen with respect to casein fiber.

It is axiomatic that a substitute fiber should have approximately the same desirable chemical and physical properties as the fiber for which it is to be substituted. It should take the same dyes and react similarly to acids, alkalies and cleaning fluids; it should have comparable elongation, tensile strength, resilience, moisture absorption, and feel. From the standpoint of chemical properties, the use of protein as the starting material for a substitute for a protein fiber is indicated. Physical properties are determined, not only by initial chemical composition, but also by chemical alteration and physical treatments.

Casein fiber has been developed in Europe with the idea that it is to become a substitute for wool. It is probable that some of the earlier work to produce artificial silk was done with casein, but it was not till 1904, after rayon was well on its way, that patents were issued to Todtenhaupt for a casein fiber. His process consisted of extruding an alkaline solution of casein into a precipitating bath containing acid, formaldehyde and alcohol. His process was unsuccessful because the individual fibers stuck together and were brittle.

The Ferretti process, by which the greater part of European casein fiber is being made, was put into commercial operation by the Snia Viscosa near Milan, Italy, in 1936. The production that year was 209,000 pounds; in 1937, 1,695,000; and in 1938, somewhat over 6,000,000 pounds.

The novelty of the Ferretti process is chiefly in the use of casein that has been exposed to the acidity of pH 2.9 during manufacture, a treatment that is claimed to impart softness to the finished fiber at the expense of some tensile strength. The term "textile casein" is used in Europe to refer to casein made in this way. This casein is dissolved in alkali, the solution ripened and extruded at a definite viscosity into an acid bath containing formaldehyde and salts. The plant and machinery are essentially the same as those used in manufacturing viscose rayon. The fiber is marketed under the name of Lanital. Casein fiber made by this process in other countries of continental Europe is sold under the names Tiolan, Polan, Casolana, and Cargau. Lactofil is a casein fiber made by a somewhat different process by the AKU in Holland. Some fiber is being made in southern Europe from mixtures of casein solution and cellulose xanthate. Cisalfa and Fibramine are said to be rayon fibers containing 4.5 per cent casein; Lacisana, one containing 3 per cent casein. Fish protein, animal protein, soybean protein and peanut protein have all been used in Europe or Japan to make fiber experimentally, and it is reported that commercial fiber has been made from some of these substances, but details of methods used and figures of production are not available.

There has been considerable research activity on casein fiber in the United States and at least three companies have made fiber on a semi-plant scale. No commercial plant is yet in operation, but it is announced that the National Dairy Products Corporation is equipping a plant in Rhode Island. Their process has unique features, but the patents pertaining to it have not yet been issued.

The only casein-fiber patents so far granted in this country are No. 2,140,274, issued to Dr. Gould and me on December 13, 1938, as a product patent; No. 2,167,202, issued July 15, 1939, and No. 2,169,690, issued August 15, 1939, as process and composition patents. These are dedicated "to the free use of the People of the United States." The claims of the first patent refer to a fiber comprising casein, salts of casein, and fat acids, and to a fiber for which the aluminum salt of casein is specifically claimed as a component. The second covers the use of skim milk suitably concentrated or fortified with concentrated forms of skim milk. The third includes the use of phosphoric acid and phosphates in the precipitating bath.

Our process does not require a specifically prepared casein as do several of the other processes, any high-grade acid-precipitated casein being suitable. Sodium aluminate or other metal compounds are added to the casein solution

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**Division of Dairy Research Laboratories, Bureau of Dairy Industry, U. S. Department of Agriculture.

to increase the strength and water-resistance of the fiber. Fat acids are added to increase flexibility. The acid bath into which the casein solution is extruded contains formaldehyde and salts or sugars to accelerate the "setting-up" of the fiber. The spinneret is of the type used in making viscose rayon. The extruded fiber is stretched, wound and treated with formaldehyde and textile oils.

Since casein fiber will differ somewhat in its characteristics, depending on the process of manufacture, and since it is being continually improved in several respects, it seems proper to discuss its properties in descriptive and comparative terms rather than listing figures obtained from tests. Comparisons are usually made with wool, to which casein fiber is inferior in certain desirable characteristics and superior in others. Since this fiber is already being used for purposes other than as a substitute for wool, its characteristics should properly be considered in direct relationship to its use rather than in comparison with those of any other fiber.

The ultimate composition of casein fiber is nearly identical with that of wool, the chief difference being in the smaller percentage of sulfur. The fiber takes acid dyes faster than does wool, which is undesirable when a mixture of wool and casein fiber is being dyed. However, casein fiber is injured by the boiling temperatures usually used in applying this class of dyes; consequently, the yarn can and should be dyed at comparatively low temperatures. Chrome, direct cotton, basic, sulfur, and vat dyes may be used for dyeing casein fiber, but the alkalinity must be kept low when sulfur or vat dyes are used. The Cisalfa type of fiber dyes more like cotton than like wool.

The usual dry-cleaning fluids cause no appreciable loss of weight when applied to casein fiber. Of spotting agents, acetone and sodium hypochlorite discolor the fiber, ammonia thins the fiber, oxalic acid makes it tender and harsh, hydrogen peroxide makes the fibers stringy and, if used warm, more lustrous. When wet, casein fiber swells, has greater stretch and breaks more easily than when dry.

Probably the chief disadvantage of casein fiber is its comparatively low tensile strength. The earlier Lanital was about one-sixth to one-fourth as strong as wool and was considerably weakened by wetting. Extravagant claims have been made for the improvement in tensile strength, but apparently the strength of the present commercial fiber is about one-half that of wool and the elongation about one-third.

Circumferentially, casein fiber is irregular in shape, longitudinally, it is smooth. Not having the scaly structure characteristics of wool, it does not felt, but, in mixtures, it does not impair the felting of wool. Casein fiber does not shrink as much as wool. It is similar to wool in crease resistance.

Casein fiber can be made so soft that it will not irritate the most delicate skin.

An artificial fiber obviously can be made of any predetermined degree of fineness and of length of staple, and both fineness and length of staple will be uniform.

A British textile man, H. A. Thomas, has listed as follows the advantages of casein fiber over wool fibers that make it of interest for admixture with wool. (1) Casein fibers are more uniform in length and in properties along that length. (2) They show no tip and root effect. (3) They possess a more uniform and continuous contour and are more lustrous than wool fibers. (4) They require no scouring and no carbonizing since no burrs are present. (5) The spinning of finer yarn is facilitated by blending casein fiber with wool.

It is interesting to note that the addition of casein solution to cellulose xanthate solution leads to a delustered rayon, which, in cross-section, shows particles of casein in the regenerated cellulose.

It is not practically possible to give an exact figure for the cost of casein fiber made in the United States. European material and labor costs cannot be translated directly into dollars and cents. However, it is a sound statement that costs of casein fiber should be approximately equal to those of staple viscose rayon. Casein normally costs from 10 to 15 cents per pound, cellulose 5 cents a pound, but the cost of carbon disulfide for rayon manufacture must be somewhat more than the cost of formaldehyde for manufacture of casein fiber. The expensive storage tanks for ripening cellulose xanthate are not required for casein fiber. The statement has been published that the investment per unit weight of product per year for casein fiber is less than half that for viscose rayon, but, until the validity of that claim has been clearly demonstrated in this country, one should be cautious in accepting it.

There is potentially available in the United States over one billion pounds of casein that could be converted into this same weight of casein fiber. This represents skim milk now being fed to farm animals. Some of this casein would not be available, because some skim milk is in small units in isolated sections of the country. However, there is a tendency to over-produce casein in the United States, and Argentina is prevented from shipping us large quantities only because of the tariff barrier and lack of sufficient demand. Therefore, there should be no lack of casein for a growing casein fiber industry.

What the future of casein fiber will be in this country is difficult to predict. Dilution of our wool supply with casein fiber appears desirable in order to provide less expensive fabrics with properties of wool for the low-income groups of our population. Casein fiber woven with cotton or rayon gives fabrics apparently of some textile interest. What effect the newer finishing treatments that are being applied to various fibers will have on the textile situation as it will affect casein fiber, only a textile expert can be expected to predict. All we can safely say is that this is a new protein fiber that will have to be considered in the interplay of the economics of the textile industry.

Semi-Resin Finishes

for Cotton Piece Goods*

W. W. TROWELL**

Synthetic resins have been used for some time for certain selected applications of textile finishing. Only recently, however, have synthetics been combined with orthodox finishing ingredients to obtain semi-resin finishes.

This development has been accomplished by the introduction of a new type of thermoplastic resins† which show exceptional compatability with starches, softeners, mineral oil, waxes, gums, gelatin, latex, sulfonated oils, and other materials commonly used in finishing.

The excellent stability of emulsions of these resins, both alone and in combination with the above mentioned ingredients, makes it possible to produce a wide variety of semi-resin finishes showing marked utility in the finishing of cotton piece goods.

A description of the handling of such resins in backfilling and pure finishing, together with attendant advantages and limitations, is presented. Also cited is the fact that these advantages can be obtained without an increase in overall finishing costs.

DURING the past few years the textile industry has been growing increasingly synthetic-resin conscious. Most of the applications to which the resins have been put, however, have been to obtain special effects which would justify the increased finishing costs involved. Examples are the use of urea formaldehyde resins in crease or crush resistant finishes, acrylate and methacrylate resins to obtain finishes resistant to laundering and dry cleaning, and alkyd resin emulsions for slip-proofing rayon. Limitations in cost and difficulties of application have restricted the use of resins of this type for replacing or combining with the usual starches and softeners in the finishing of cotton piece goods.

One of the most recent contributions to cotton piece goods finishing has been the development of a soft, permanently thermoplastic synthetic resin which is compatible with practically all of the starches, softeners, and gums commonly used in the preparation of finishing mixes. This resin is now being used in combination with orthodox finishing materials to produce semi-resin finishes on a variety of constructions. The partial replacement of starch and vegetable oil or tallow softeners by means of a synthetic material appears to be an extremely timely development, especially if the price structure of starches and food commodities follows the pattern of the last European war.

LABORATORY DEVELOPMENT

At the outset our work was not directed toward a deliberate attempt to make a textile resin. It was, on the other hand, the outgrowth of a study of various resins which was in progress at our research laboratories. In common with the established procedure of testing new compounds of this nature, the marked compatibility of this new thermoplastic resin with starches and other ingredients commonly used in textile processing was at once pronounced. These compatibility tests were run by mixing the resin in question with other substances, applying thin films to glass plates and allowing to dry. It was noticed in the tests with starch that there was a greatly increased adhesion of the starch film to the glass plate. The friability of the starch film was decreased and there was a marked improvement in the translucency of the film over a straight starch film. On the basis of these results our textile laboratory predicted it would serve a valuable function in backfilling where the binding action was of tremendous importance and where the matching of colors from back to face was also important. With this objective in mind work was begun in the laboratory on backfilling of textile fabrics and the results indicated that the experimental work on glass plates was readily confirmed. Starches, as a rule, were decreased 20-30 per cent and it was found possible to reduce the softeners in some cases by as much as 80 per cent.

Before going further, however, in textile application a large amount of work was done to determine both the degree of permanence of the finish and whether cloth finished in this manner would be adversely affected as to strength, discoloring, or stability of finish. The results of some of this work, and the pertinent conclusions therefrom are described in some detail below.

TENSILE STRENGTH

Table I shows that the resin in question in admixture with starch rather noticeably improves the tensile strength over untreated yarn and at the same time does not adversely affect the elongation.

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**Synthetics Department, Hercules Powder Company, Wilmington, Delaware.

†The soft, thermoplastic, synthetic resin discussed in this paper is manufactured by Hercules Powder Company and is known by the trade name Textac. (Reg. U. S. Pat. Off.)

TABLE I

Ingredients in 100 Gallons	*Av. Break Gms.*	*Av. Elongation %*	*Increase in Breaking Strength Over Control %*
Unsized (Control)	371.9	6.07	...
50 lbs. Potato Starch	393.7	7.10	5.86
30 lbs. Potato Starch			
20 lbs. Resin Emulsion	415.9	8.07	11.83
50 lbs.-60 Fluidity Corn Starch	387.7	8.85	4.25
30 lbs.-60 Fluidity Corn Starch	441.4	8.00	18.69
20 lbs. Resin Emulsion			

Skein 19/1 cotton yarn was impregnated with starch and resin mixtures, as tabulated in Table I, run through squeeze rolls, dried in an oven at 220° F. and aged overnight in the constant humidity room (65 per cent R.H.—70° F.). Break strength and elongation tests were then made on the Scott Incline Serigraph—Model I.P. 2.

Likewise, in Table II these results were confirmed on a textile fabric where only resin and sulfonated oil were present.

TABLE II

Tensile Strength Tests

Semi-resin finishes impart to fabrics greater tensile strength than is obtainable with straight starch finishes.
Example—1.80 yd. Gabardine.

Tensile Strength	*Warp*	*Filling*	*Increase*
Untreated	142 lb.	121 lb.	
Semi-resin Finish.	150 lb.	139 lb.	Warp— 6%, Filling—15%
Regular Finish ..	144 lb.	127 lb.	Warp— 1½%, Filling— 5%
Tear Tests			
Untreated	17 lb.	12 lb.	
Semi-resin Finish	19 lb.	15 lb.	Warp—12%, Filling—25%
Regular Finish..	17.8 lb.	13.5 lb.	Warp— 5%, Filling—12%

All tests the average of ten breaks on Scott Tester.
Determination made on cloth condition at 70° F. and 70% R. H.

From these results it can be readily appreciated that there is every indication of a definite improvement in tensile strength.

DISCOLORATION

Discoloration was approached from two standpoints: heating and ultraviolet light. The method employed was to impregnate 1 per cent of the solid material from an emulsion on 2.85 yd. sheeting in the padder box and dry over cans in the usual manner. Test swatches thus prepared were compared to swatches treated with like amounts of sulfonated tallows and vegetable oils (which the resin was largely replacing) by each of the following three methods:

1. Heating in oven at 220° F. for 18 hours in a continuous change of air.
2. Ironing with an iron at 300° F. for 1, 3, and 5 minutes.
3. Exposing in a Fade-Ometer for 24 hours at 120° F.

The samples were in all cases subjected to visual inspection and graded according to their tendency toward discoloration. The results were purely empirical, but indicated that the resin finish was at least equal to, and in some cases superior to, the other texitle finishing agents to which the resin was compared.

PERMANENCE

The permanence of finish was determined by two separate methods:

1. The resistance to removal by laundering, dry cleaning, etc.
2. The permanence of the finish with ageing.

For wash fastness and dry cleaning, both backfilled and pure finishes were applied to cotton fabrics and to rayon, which included starches and softeners in many different formulations. Cuttings of the finished fabric were then weighed at a definite humidity, and after washings and dry cleanings made by the Associated Laundries of Wilmington, Delaware, the cuttings were again weighed, to determine the loss in weight of the finish.

The following general conclusions were reached:

1. *Backfilling Finishes.*
   a. Straight Starch—Talc—Softener finishes lose about 90 per cent size on one washing.
   b. Resin—Starch—Talc—Softener finishes of comparable filling lose about 40 per cent in one wash.
2. *Pure Finishes.*
   a. The wash fastness of the finish varies with the amount of water-soluble bodies present in the finish.
   b. Resin finishes containing relatively small amounts of starch retain about 50 per cent size on 5 washes.
3. *Rayon Finishes—Dry Cleaning.*
   a. Resin-containing finishes lose about 10 per cent size in Carbon Tetrachloride and V. M. & P. Naphtha on one dry cleaning.
   b. The same resin finishes lose about 50 per cent size in Perchlorethylene and Stoddard solvent on one dry cleaning.

It can be seen from these data that the resin finishes are by no means to be considered as permanent finishes. They do, however, appear to possess greater permanence than the usual starch and softener finishes.

In the determination of the stability of the finish on ageing a number of mixes were applied to cloths of different constructions and the stiffness of the resulting fabric determined by the W. and L. E. Gurley Stiffness Tester. The results of a typical comparison are shown in Table III.

TABLE III

Relative Stiffness on Ageing of 8 oz. Duck Impregnated with Semi-Resin and a Comparable Starch-Softener Finish as Determined by the W. and L. E. Gurley Stiffness Tester

	Semi-Resin Finish	*Starch-Softener Finish*
First day	134 mg.	175 mg.
Second day	135 mg.	172 mg.
Third day	137 mg.	165 mg.
Fourth day	134 mg.	164 mg.
Fifth day	138 mg.	162 mg.
Sixth day	136 mg.	162 mg.
Seventh day	137 mg.	159 mg.
Eighth day	137 mg.	155 mg.

It will be noticed that the resin-starch finish maintains its original stiffness without change over a 7-day period of ageing, whereas the starch finish loses approximately 12 per cent of its stiffness in the same period. This we

consider is a definite improvement because it is well known that starch finishes are, in the majority of cases, over-finished because of the mellowing that takes place on ageing.

PLANT DEVELOPMENT OF BACKFILLED FINISHES

The properties of this resin were apparently sufficiently interesting in the field of textile finishing that practical development and test of resin-containing finishes was undertaken. Actual mill tests have confirmed our ideas.

The practical development of backfilled resin finishes has met our utmost expectation from every standpoint. Successful trials have been run on

6 oz. Duck	48/44 Sack Cloth
3.70 yd. Narrow Sheeting	64/44 Cambric
80/60 Broadcloth	4.25 yd. Twill
68/72 Shirting Cloth	42/46 Muslin
Backfilled cloth for artificial leather	2.00 yd. Twill Backfilled Towelling
64/60 construction	2.85 Slub Cloth
64/64 Wide Sheeting	64/60 Print Cloth
68/72 Pillow Case Cloth	Window Shade Cloth
Shoe Cloth	Book Cloth

It is useless to attempt to give specific formulation for each and every type because in a number of cases the same construction is being backfilled with entirely different formulas, depending upon the results desired by individual plants. In the main, it can be stated that some very complex backfilled finishes, consisting sometimes of as many as 8 different ingredients, have been reduced to a very simple system of resin, starch, softener and inert filler, the variation of these components depending, as mentioned above, on the results desired. Numerous tests, both by pounding of the cloth and by tearing against a black background, have shown that 40 pounds of a 33-1/3 per cent resin emulsion to 150-gallon mix will successfully bind in 200-400 pounds of talc. In most cases it has not been necessary to tint the backfill mix, as the translucency has been sufficiently good to obtain a match between the back and face of the fabric. It should be noted that the addition of this type of resin to a mix gives a creamier, smoother mix which results in better running and usually greater yardage per mix. Actual machine trials with full sized mixes on 3.70 yd. sheeting and 80/60 broadcloth, both of which were backfilled, gave the following yardages in comparison with the standard mix without the resin where the finish was considered a match. These results are given in Table IV.

TABLE IV

Comparison of Yardage Obtained From Typical Mixes

3.70 YD. SHEETING	
Standard Finish	7,500 yds. per 160-gal. mix
Semi-Resin Finish	8,800 yds. per 160-gal. mix
80 x 60 BROADCLOTH	
Standard Finish	8,500 yds. per 160-gal. mix
Semi-Resin Finish	9,900 yds. per 160-gal. mix

Yardage runs of this nature must be expected to show considerable variation, but the above may be considered as typical of the vast majority of cases. In some cases, where the viscosity had to be maintained at a very high point, a special technique had to be worked out in order to get the maximum viscosity from the starch employed. Usually, if the resin emulsion is added to the starch directly, the resin prevents the proper swelling of the starch on subsequent cooking and results in low viscosity. Therefore, it was found that if the starch, the softener, the inert, and most of the water of the mix were brought to a boil, the resin emulsion was added at the point just prior to where gel structure became so stiff that admixture of the resin emulsion was difficult, and the boil continued from 2 to 4 minutes after addition of the resin, a creamy, well-bodied, backfilling mix results. Such mixes have shown tremendous advantages in the filling of open, loosely woven constructions which are ultimately designed for coating with either pyroxylin lacquers or oil paints. Thus, in artificial leather and window shades a high degree of filling of the base construction can be obtained with the maximum of flexibility which reduces the amount of finishing coats which are necessary to get the desired results. It is interesting to note that it has been found possible to preshrink backfilled fabrics, after filling, when a thermoplastic resin has been incorporated in the backfilled mix. This is largely due to the better binding action produced by the resin. The chief precaution in preshrinking is to get the goods wet out as quickly as possible. This is usually accomplished by increasing the amount of steam and decreasing the amount of cold water.

By way of summary, the use of semi-resin finishes in backfilling can be practically accomplished on currently used textile equipment without any undue technical complications. The results show a superiority from the standpoint of dusting of the inert ingredient and starch, more resistance to breakdown on ageing, and better uniformity of color value between the back and the face.

With the resin with which we have worked it is possible, in most cases, to secure all the advantages when the reduction of starch and softener is replaced on a money value basis with the resin, thus showing no increase in over-all finishing cost. In complicated formulas, where additional binders, as glues, etc., have been used, it is quite often possible to produce a definitely better filled fabric with the advantages of freedom from dusting and better color value at a definite saving in over-all cost.

PLANT RESULTS ON PURE FINISHES

At the present time pure semi-resin finishes are being successfully applied to

80/80 Print Cloth	Luggage Cloth
68/72 Print Cloth	Gingham
Glazed Chintz	Corduroy
8 oz. Duck	2.35 yd. Sulfur and Vat Dyed Twills
2.85 yd. Sheeting	
2.30 yd. Sanforized Gabardine	99/44 Poplin
2-50 yd. Herringbone Twill	Denim
2.85 yd. Jeans	Chambray
Cotton or Rayon Suitings	Ticking
Sanforized Cotton Suiting	2.50 yd. Hop Sacking
Drapery Cloth	100/60 Broadcloth
Upholstery Cloth	2.50 yd. Sanforized Sheeting
	112/60 Sanforized Broadcloth

Here again the formulation has been varied over a wide degree, sometimes consisting of softener, starch and resin, sometimes of softener and resin alone, and at other times of starch and resin alone, all depending upon the specific results desired. It is recognized that increasing the amount of starch will increase the stiffness of the resulting finish. The resin adds flexibility and toughness to the starch, thus reducing the tendency toward boardiness. On the other hand, increasing the softener or decreasing or eliminating the starch enables the finishers to produce an extremely soft, yet well bodied, fabric. Thus, the influence on a duck finish is a full, tough, leathery hand, while in contrast, print cloth can be made having a fuller, clothier feel.

In general, the outstanding advantages of the addition of a soft, thermoplastic resin to a starch, a softener, or a starch-softener mix may be summarized as follows:

1. Superior body and fullness.
2. Brighter colors due to the increased translucency of the mix.
3. Better toughness and flexibility.
4. Increased uniformity of the finish from selvedge to selvedge.
5. Better stability of the finish.

Needless to say, pure finished goods can be preshrunk without any great difficulties, following the precautions mentioned under backfilling.

A few of the unusual results which have been encountered in pure finishes are worth noting. Thus, on heavily sulfur dyed fabrics where the starch finish tends to remain on the surface and readily shows scratch marks, the use of a soft, thermoplastic resin binds the starch more securely to the fabric and thus prevents scratching. This has been particularly noticeable on navy and khaki dyed twills and gabardines. On naphthol dyed fabrics, especially in the red shades, the tendency toward crocking is reduced to a large extent. When used with wheat starch the finish can be friction calendered to a very high gloss which, because of its increased flexibility and toughness, produces a more durable glazed chintz.

Pure finishes, as well as backfilled finishes, can be applied in currently used textile equipment. When the resin component is of the soft, thermoplastic type, the mixes are smooth, starch has less tendency to lump, and yardages are often improved. Typical yardage improvement is shown in Table V.

TABLE V

Yardage Obtained From Typical Finishing Mixes

8-OZ. DUCK	
Standard Finish	5,500 yds. per 160-gal. mix
Semi-Resin Finish	7,500 yds. per 160-gal. mix
2.00 YD. TWILL	
Standard Finish	5,100 yds. per 160-gal. mix
Semi-Resin Finish	6,800 yds. per 160-gal. mix

With increased yardages of this nature, combined with the saving in starch and softener, it is often possible to show a reduced finishing cost even in pure finishes, at the same time taking full advantage of improved results.

The mixes, if heavy, are made in much the same manner as backfilled mixes. However, in lighter mixes it is recommended that the starch be cooked with one-half the water, diluted to approximately the final volume for cooling, and the resin emulsion added when the temperature drops to 140-150° F. The mix is then ready for run with no further cooling. This insures greater stability of the mix during processing. Pure finishes without starch should be run at approximately 120° F. to insure the maximum penetration and at the same time avoid any tendency to coagulate or break the resin emulsion, which heat may do in the absence of the protective colloid action of the starch.

OTHER APPLICATIONS

Our experimental and field work has been confined almost entirely to the field of cotton piece goods, but textile men will undoubtedly be interested in investigations of soft, thermoplastic resins for other textile uses. For this reason we mention the fact that the soft, thermoplastic resin with which we have worked is compatible with the following materials, all of which are well known to the textile trade:

Mineral oils	Gum Tragacanth	Nitrocellulose
Waxes	Latex	Ethyl Cellulose
Gum Gatto	Gelatine	

It is particularly noteworthy that resins of this nature, if compatible with mineral oils, have a bodying influence and definitely increases the stability of mineral oil emulsions.

It is therefore conceivable that semi-resin finishes may, with further development, find their way into numerous other fields. It is believed that this resin may prove to cost no more than present finishing ingredients when used on other than cotton goods, for the same reasons as set forth earlier with respect to cotton goods finishing.

DISCUSSION

President Eavenson: I am sure that we have all appreciated Mr. Trowell's paper. It would seem almost certain that these synthetic products have come more and more into use. They may be modified almost at will. The meeting is open for discussion.

Mr. Whitman: I would like to ask two questions. What are the prices of some of these resins and what type of resins are they?

Mr. Trowell: I have tried to explain that the resins which we are referring to are thermoplastic. They vary in price considerably, depending on the type of application you have in mind. We sell some of them as cheap as ten cents a pound, others at twenty cents a pound.

Mr. Whitman: I was thinking of the resin that increased the tensile strength.

Mr. Trowell: Ten cents a pound.

Mr. Whitman: What is its chemical nature?

Mr. Trowell: It is thermoplastic.

Am. Dyestuff Reptr. 28 (1939)

A New Type

Water Repellent*

GEORGE A. SLOWINSKE**

THE water repellency of textiles always has been an important problem of the textile industry, and it will be of greater concern in the future. With few obvious exceptions, every textile material, yarn, or fabric is increased in value and utility when its resistance to wetting is increased. Practically every article of clothing and every article exposed to the weather during use can be made to yield greater satisfaction during its life by treatment with an agent capable of imparting resistance to water. In many cases the entire value of a textile article (e.g., tarpaulins, ducks, raincoats, etc.) is directly dependent on its water resistance.

Unfortunately, the materials and compositions used in the past to proof textile materials possessed serious limitations. They imparted proofness at the expense of other desirable properties. A big advance was made when the one-bath, wax-type proofing emulsions made their appearance. But they in turn all possessed, and still possess, a serious drawback. They produce only temporary proofness, which does not withstand laundering or dry cleaning or the effects of exposure during use. But the "World of Tomorrow" is just around the corner.

One of the newest representatives of this "World of Tomorrow" in textiles is "Zelan," a durable repellent. The product is based on initial research and discovery of the Imperial Chemical Industries, Ltd., of England. Its development and commercial application are the result of cooperative work of the I. C. I. in England and the du Pont Company in this country. "Zelan" is its American name, and Velan its English name. The first publication[1] describing it in this country appeared in November, 1937, and its commercial development in this country was announced[2] in December, 1938. It now is in regular commercial use by textile finishing mills. It is being used on all types of textiles including linen, cotton, silk, wool and the rayons. It is being used on fabrics as widely dissimilar as cotton ducks and silk dress goods. Flags, pennants, and sailcloths treated with "Zelan" possess exceptional properties. Treated flags resist soiling and last longer because they do not become wet and heavy in rainstorms. Sailcloths likewise perform with almost unexpected satisfaction. In addition, their resistance to mildew is increased since they do not retain moisture when removed and stored in damp places.

This new product produces new and novel water-repellent and soft finishes on all types of textiles which are characterized by their durability or resistance to removal. For these reasons "Zelan" is a valuable addition to the ever increasing number of agents available to the textile industry to increase the value, utility and appeal of the industry's output of finished textiles. It can be used where appearance, air permeability, drapability and resistance to general soiling are necessary properties. It can be used on materials which are of value solely for utilitarian purposes and also on fine dress fabrics where fashion and novelty are paramount.

The exceptional properties of "Zelan" A (the type currently offered) are due to the fact that it differs from all other water repellents on the market. The product differs in chemical constitution, chemical and physical properties, and application method. It is a single chemical type in the form of a white flaky powder, and not an emulsion or solution of different ingredients. It imparts water repellency by combining with the textile to form a durable water-repellent complex, and not by depositing a film or layer of water-repellent material on the surface. Chemically "Zelan" A is a long-chain, quaternary ammonium compound. Its composition and process of application to textiles have been covered in United States and English patents and patent applications.

The actual mechanism of "Zelan" A's combination with textiles has not been definitely established. But during its application it splits up, and the reaction products combine with the textile to form a complex which repels water. A number of interesting theories[3] have been described in the literature. However, any assumption that its combination with textiles is strictly a chemical reaction, is complicated by the fact that it produces repellent effects on both cellulosic and animal fibers. Conversely, its union with textiles is not a purely physical phenomenon, since it does undergo chemical change during its application, and after application it cannot be removed by known solvents.

*Presented at Annual Meeting, Boston, Mass., September 15, 1939.

**Fine Chemicals Division, Technical Laboratory, E. I. du Pont de Nemours & Co., Inc.

[1]Lenher, Samuel, American Dyestuff Reporter, *26*, 785 (1937).

[2]American Dyestuff Reporter, *27*, 778 (1938).

[3a]"A Special Correspondent," The Chemical Age, *40*, 61 (1939).

[3b]"By Analyst," Silk Journal & Rayon World, *14*, 31 (1937).

But, it is this reaction during application which accounts for "Zelan" A's novel properties and marked advantages over wax-type water repellents and coating compositions. The water-repellent finishes obtained with it are equal in all respects to those obtained with all other water repellents. But its property of combining with fabrics gives it a durability to washing, dry cleaning and exposure during use not possessed by any other product at present commercially available. It contains no wax emulsifiable in detergent solutions or soluble in dry cleaning solvents. It contains no aluminum salts removable by laundering operations. The following data illustrate its durability:

TABLE I
Repellency Data on a Mercerized Vat-Dyed, Cotton Gabardine Fabric

Number of Launderings (Note A)	*Rating in Spray Test (Note B)*	*Rating in Spot Test (Note B)*	*% Absorption in Immersion Test (Note B)*	*Centimeter Reading in Hydrostatic Pressure Test (Note B)*
		Treated with "Zelan" A		
0	100	100	19.5	34.0
1	85	90	20.0	17.0
5	80	90	19.0	18.5
10	70	85	19.0	17.0
20	60	80	22.0	14.5
		Treated with Commercial, One-Bath, Wax-Aluminum Salt Proofing Agent		
0	90	95	23.5	31.0
1	10	50	56.5	5.0
2	0–10	0	60.0	5.0
		Untreated		
0	0	0	60.0	0

NOTE:

A. The laundering operations were carried out in a rotary wash wheel for 30 minute periods at 160° F. in a solution containing 0.25 per cent soap and 0.1 per cent soda ash.

B. The Spray, Spot, Immersion and Hydrostatic Pressure Tests are tests standardized for use in the laboratories of E. I. du Pont de Nemours & Co., Inc.

The Spray Test measures the resistance to surface wetting. It is similar in principle to those discussed by Walter M. Scott in the September 5, 1938, issue of the AMERICAN DYESTUFF REPORTER[4]. A sample of fabric is held taut in a frame and subjected to a controlled spray of water. At the end of the spraying period the fabric is manipulated to remove losely held water and then rated or compared visually with a standard chart where "100" represents maximum repellency and "0" represents no repellency (complete wetting and penetration). Intermediate stages of wetting are represented by intermediate numbers, with "50" representing complete surface wetting but no penetration through the fabric.

The Spot Test is a simple test in which a one cubic centimeter volume of water is allowed to remain on the surface of the fabric for 3 minutes and then shaken off. The tested fabric is examined visually and rated in accordance with a set of standards similar to that used in the Spray Test.

The Immersion Test measures the resistance of the fibers in a fabric to the absorption and retention of water. Similar tests are discussed by Walter M. Scott in the September 5, 1938, issue of the AMERICAN DYESTUFF REPORTER[4].

The Hydrostatic Pressure Test is similar in principle of operation to the "Hydrostatic Pressure Test" described and illustrated in the Year Book of the American Association of Textile Chemists and Colorists[5].

The data in Table I illustrate the relative durability of a "Zelan" finish. The repellency tests themselves are described only briefly in the footnotes of the table, since a detailed discussion is not pertinent to this article. The A.A.T.C.C. Sub-Committee on the Water Resistance of Fabrics is, at present, studying test procedures.

As shown in Table I, the repellent finish produced with "Zelan" is not permanent in the strict sense of the term[6]; the effect is slowly reduced by prolonged laundering or dry cleaning. But extensive large scale tests have demonstrated that a "Zelan" finish will last through the normal life of garments or articles made from treated fabric. This resistance to removal of the finish is the factor that justifies its classification as a "durable finish." Actual wear tests have shown that a considerable portion of the finish is still in evidence when articles become unserviceable as a result of wear. The data in Table I illustrate this point. After 20 successive laundering operations the "Zelan" A treated fabric still rated "60" in the Spray Test. This rating means that in the test the laundered fabric wetted partially on the surface, but that penetration into or through the fabric did not occur. Likewise, the reading in the Hydrostatic Pressure Test after 20 launderings was 14.5 centimeters as against 34.0 centimeters initially on the treated fabric. The behavior of the "Zelan" A treated fabric in the Immersion Test is even more striking. On subjection to 20 launderings the per cent absorption increased from 19.5 per cent to only 22.0 per cent in a test where the untreated fabric absorbed 60.0 per cent. In comparison, the fabric treated with the wax-aluminum salt proofing agent exhibited little actual repellency after one laundering. The laundering operations were made under conditions equivalent to those used by commercial laundries in laundering dyed fabric. It is of interest to note that all of the test fabrics after subjection to the 20 launderings were degraded to such an extent that

[4]Scott, Walter M., American Dyestuff Reporter, *27*, 479 (1938).

[5]"1938 Year Book of the American Association of Textile Chemists and Colorists," *15*, 187 (1938), Howes Publishing Company, New York, N. Y.

[6]Smith, R. J., The Journal of the Society of the Dyers and Colourists, *54*, 407 (1938).

they could not be classed as serviceable fabrics. They were badly worn and abraded.

The novel character of the water repellency produced by "Zelan" can be demonstrated by other means than by data on its fastness properties. The older wax compositions are only resistant to wetting by water at low temperatures, or at temperatures substantially below the melting point of their wax component. A "Zelan" A finish differs in this respect. It is resistant to wetting by water at low temperatures and at relatively high temperatures. In a series of tests weighed samples of treated fabrics (each 3 inches by 3 inches) were held under water by means of weighted clips attached to their lower edges. The upper edges were 2 inches below the surface and their lower edges were 5 inches below. At the end of a 20 minute soaking time, the samples were removed, each placed between 2 sheets of dry blotting paper to form a sandwich, which then was squeezed through a wringer. The squeezed samples were quickly weighed. The weights of water absorbed and retained by the samples were calculated as percentages of their dry weights. The water was adjusted to various temperatures. The following data were obtained on a cotton bunting fabric treated with "Zelan" A and with a commercial, one-bath, wax-aluminum salt proofing agent.

TABLE II

Absorption Data on a Cotton Bunting Fabric

Condition of Fabric	*Water Absorbed and Retained by Fabric in Tests at Indicated Temperatures*					
	40° F.	80° F.	120° F.	160° F.	200° F.	Boil (212° F.)
Treated with "Zelan" A	18	18	18	24	54	54
Treated with commercial, one-bath, wax-aluminum salt proofing agent	21	23	47	58	62	62
Untreated	—	65	—	—	—	64

The data in Table II show that a "Zelan" treated fabric resists wetting by water at elevated temperatures to a very much greater extent than a fabric treated with a wax emulsion type product. The water absorption data for "Zelan" A at 160° F. and for the wax-aluminum salt proofing agent at 80° F. are substantially the same. For this reason the new finish on a fabric is unique in its resistance to hot liquids or beverages.

Fabrics treated with the new agent are water-repellent or water-resistant fabrics, but are not waterproof fabrics[7]. The treatment imparts repellency without coating, filling or stiffening fabrics. In other words, the fibers and yarns are rendered repellent or resistant, but the pores or interstices between the yarns are not closed. Thus "Zelan" possesses the same advantages as the usual water repellents and can be used on all types of wearing apparel where hygienic considerations make "breathing" essential. The additional soft finish of all "Zelan" treated fabrics is striking. The soft finish is of exceptional value on those wearing apparel fabrics which require draping qualities (dress goods, etc.). Like the repellent effect it is resistant to removal by laundering, dry cleaning or exposure during use. The durable, soft finish also can be produced with much lower concentrations of the agent than are necessary to produce the repellent effect. Concentrations of around 5 per cent are usually used in imparting repellency while concentrations of 0.1-0.5 per cent will impart softness.

"Zelan" is applied to textile materials in a final operation (e.g., subsequent to preparatory operations, such as desizing, kier boiling, bleaching, mercerizing, dyeing or printing). It is applied to either white or dyed or printed material. In special instances it may be applied to white material intended for subsequent dyeing, but in general such a process is not commercially practical. Since it combines with textiles during application it is applied to materials which are as free as possible of sizing or finishing agents, such as starches, dextrins, soaps, sulfonated oils, sulfated fatty alcohols, and vegetable gums. Such materials either interfere with the combination of "Zelan" and textile, or mask or decrease the resultant repellent effect. The product can be applied along with urea-formaldehyde resins to produce combination water-repellent and crease-resistant effects.

The application of "Zelan" A to all types and classes of textile materials involves the following four steps:

1. Impregnation from an aqueous solution at a low temperature.
2. Drying quickly at a low temperature.
3. Heating or curing for a short time at a high temperature.
4. Washing mildly or neutralizing in a solution of a wetting agent and a mild alkali, followed by rinsing.

The process requires careful control at every stage, but production work in textile finishing mills has demonstrated that uniform results can be obtained with suitable equipment. The equipment necessary is of the more efficient type now used by the textile industry. The process is not suitable for application in the home or in laundries, nor to finished garments or other articles.

The impregnation step is carried out at 90-110° F. from a water solution prepared at 105-110° F. The concentration of "Zelan" A in the impregnation solution is adjusted to deposit the following concentrations on the textile:

TABLE III

Concentrations of "Zelan" A Used to Impart Durable Water Repellency to Textiles

Textile	*Concentration of "Zelan" A on Textile*
Cotton	4-6%
Linen	4-6%
Viscose process rayon	4-6%
Cellulose acetate rayon	3-6%
Silk	3-6%
Wool	4-6%
Mixtures	5%

[7] "Waterproofing Textile Fabrics," Pearson, H. P., The Chemical Catalogue Company, Inc., New York, N. Y. (1924).

The drying step is carried out at as low a temperature as possible and as quickly as possible. The object of the drying step is to remove the water without decomposing the "Zelan" A. The ideal drying temperature is, therefore, 110° F., or even room temperature. Such a procedure is not feasible on a practical scale, but the drying step is so conducted as to approach this condition as closely as possible. It has been found that the step can be carried out with air temperatures as high as 200° F., when dryers possessing high air circulation and high exhaust facilities are used.

The heating or curing is carried out at a temperature of 290-310° F. for a period of 2-4 minutes. Heating temperatures above 310° F. also may be used, but heating temperatures below 290° F. yield inferior results. The heating or curing step is the key to the process. During this operation the dry "Zelan" A combines with the dry textile to produce the repellent complex.

The washing or neutralizing step is the final stage in the application of "Zelan" A to all types of textiles. It consists of a mild wash with a solution of a wetting agent and a suitable alkali. It removes unchanged reagent and by-products of the combination formed during the heating step. A surprising effect is that the repellency of the textile actually improves as a result of the washing. After washing, the textile is rinsed thoroughly and finished in accordance with normal finishing procedure. Fabrics can be subjected to shrinking or Sanforizing operations, if desired.

"Zelan" finished textiles, because of their new properties, are at present extending the popularity of proofed fabrics to types not previously considered, and as a consequence, are serving to increase the use of all types of water repellents. In addition "Zelan" is a typical example of the newer type finishes which impart useful effects on textile materials by combination with the fiber. It is a forerunner in a field which offers tremendous possibilities and which is receiving increasing attention in textile research.

DISCUSSION

President Eavenson: I am sure we all appreciated Mr. Slowinske's paper. Are there any questions?

Member: Will it stand abrasion?

Mr. Slowinske: Yes, it stands abrasion remarkably well. That is another advantage which Zelan A has over the ordinary finish.

Member: Could it be applied to raw stock of any kind?

Mr. Slowinske: It can, but at the present time the practical application steps have not been worked out.

Mr. Klinge: Can a fabric which has been dyed and treated with Zelan be re-dyed if the original dyeing operation was incorrect?

Mr. Slowinske: The answer is yes and no. (Laughter.) As I pointed out in my talk, Zelan A can be applied to white fabric prior to dyeing, but in general we would not recommend such a step.

On the other hand, Zelan-treated fabrics have been successfully re-dyed. It would depend on the equipment used and the fabric.

MEETING, SOUTHEASTERN SECTION

THE Southeastern Section held its fall meeting at Fort Benning, near Columbus, Ga., on Saturday evening, October 7. The delegates were taken on a tour of Fort Benning, the largest infantry training school in the United States, through the courtesy of General Asa L. Singleton, Commandant, and Major J. R. Edens, Public Relations Officer of Fort Benning. This tour began at 5:00 P. M. and terminated at the Officers' Club where the meeting was held beginning with a dinner. There were 127 registered in attendance, most of them members of the Southeastern Section, with the following mill executives among the special guests: Edward W. Swift, President, Muscogee Mfg. Co., Columbus, Ga.; Frank B. Bradley, Vice-President, Eagle & Phenix Mills, Columbus; Forbes Bradley, Vice-President, Columbus Mfg. Co., Columbus; Norman S. Illges, President, Shannon Hosiery Mills, Columbus; R. M. Nuff, Vice-President, Eagle & Phenix Mills, Columbus; and Paul K. McKenney, President, Swift Mfg. Company, Columbus. Robert W. Philip, Editor of *Cotton*, Atlanta, Ga., presided as chairman of the Section. E. A. Feimster, Supt. of Finishing at the Eagle & Phenix Mills, Columbus, was in charge of the local arrangements.

The program consisted of two papers. Philip H. Stott of the Technical Laboratory of the Dyestuff Division, E. I. du Pont de Nemours & Co., Wilmington, Delaware, presented the same paper on "The Dyeing of Nylon" that he originally delivered at the Annual A. A. T. C. C. Convention in Boston on September 15. The other speaker was John A. Simmons, General Manager, Lanett Bleachery & Dye Works, Lanett, Ala., who spoke generally on differences in conditions in the dyeing and finishing industry at the present time compared with those of 1914.

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SHOULD THE LITTLE FELLOW BE PROTECTED?

IT is difficult to imagine anything which would prove more disastrous to the future prosperity of this nation than to lessen the hope of gain on the part of individual inventors. Now that there are some 1,800 industrial rerearch laboratories, employing 32,000 people and spending as much as 200 million dollars a year, research has become big business. Organized industrial research, in fact, has become such a big business, it is easy to overlook the individual inventors. So, when investigations are being made to gather data which will be used in changing the patent laws, the main consideration is likely to be given to organized rather than to unorganized research.

Should real or imaginary evils be found and the laws changed to eliminate these evils it may happen the little inventor is also eliminated. Organized industrial research is conducted because of competition. It is not so much a matter of promoting progress as it is a case of promoting profits. The entirely new industry must conduct industrial research in order to develop itself to the point where profits can be made. The old industries have been forced to undertake industrial research because that is the only way to meet the competition of new industries and other old industries which have taken up research and continue to make a profit.

Organized industrial research, therefore, is a type of planned economy. Each industry confines its work within certain limits. The main object is to meet competition successfully, to make more profit than would otherwise be possible. No better evidence could be presented that this type of research pays than the fact that during the past twenty years the amount of money annually spent in organized research work has increased by some eight times.

In such research laboratories there are staffs of highly trained workers. In addition to all that the best universities and other schools can teach them, they have been given special training in the laboratory itself. The laboratories in which they work are provided with all facilities needed. In the case of each problem attacked there is sufficient financial backing available. To a very considerable degree this is research deluxe.

Because of the money invested in the laboratories, because of the money paid in salaries and other operating expenses of the research, because of the thoroughly organized manner in which the work is done and especially because of the great size of the corporations which have the largest laboratories, it is this type of research which attracts the most attention of everybody. The large corporations have their efficient publicity and advertising departments which are in a position to control the publicity given the work done. These things which are to be used soon to improve products or improve service rendered or entirely new products which are to be placed on the market are given the greatest publicity. Anything which, for any reason, it is desired to hold back for use at some future date may be kept pretty much a profound secret. Everything is so well organized that everything is pretty much under control.

Big things always attract so much attention that they make it easy to overlook little things. Therefore, it is easy to overlook the fact that there are still millions of individual inventors. Some of them have their cellar or attic workshops or laboratories. They may spend only spare time in them. The work at which they earn their living may have little or no connection with the research work they are doing. There are others who devote their full time to research and inventions in little shops of their own. They may be making a fair living at what they are doing. They may not be able to earn enough to be always certain of even one meal every day. Some of them succeed in making discoveries or making inventions from which they gain considerable wealth. All of them are looking forward to the day when they will be able to live like kings on the royalties they will be paid on some invention. As a class they do not differ so much from the old time gold prospector.

A lot of these people are impractical. Not all of them, by any means, are well educated. There are some who are so unfamiliar with what cannot be done that they go ahead and do it anyhow. As a matter of fact, there is some question in regard to whether the Wright brothers would ever have gone ahead and made an airplane which would fly had they been possessed of a highly technical education which would have made them more familiar with the obstacles to overcome than they were.

This does not mean that a good technical education is not an advantage in research work. For much of the work being done such an education is absolutely essential.

What is meant is that a more healthy condition exists when there are these millions of independent workers, more or less qualified by education for what they are doing, who ignore the fact that some things are impossible. What they accomplish tends to keep the trained research worker on his toes and makes him do better work than would otherwise be the case.

The day of individual accomplishment is by no means over. Here is a man who develops a simple calculating machine. Here is another who produces an improved automobile jack. Another works out a better photographic developer formula. Somebody else stumbles upon something entirely new in some branch of chemistry.

All these people are doing this individual research work for two reasons. One is that they find real enjoyment in it. It is more or less of a hobby with them. In a great many cases it is still a hobby when they devote all their time to it rather than their spare time. Their work is not likely to be any too well organized. They may continue at it all their lives or only for a few years. Their interests may change from one thing to another. They are really working for fun. For the second reason, however, they have a good excuse for this fun. At any time they may hit upon something on which they can get a patent and which can be sold for a goodly amount. There is always this chance. There is always a worthwhile prize in view.

The story of the man with the little plant in which he was striving to produce a synthetic product he had developed is not yet as uncommon as the uninformed may think. This man lacked capital. It was a question whether he could keep going at all or would lose everything he possessed. When he was down to about his last cent he made contact with a large corporation in the same field. He opened negotiations with this company and finally closed a deal for a half a million dollars.

Now, the corporation which paid this individual research worker the half million dollars had a large laboratory of its own. It was staffed with highly trained men. It is possible the identical processes the individual developed might have been developed in the company's own laboratory. At any rate, the company did consider what the individual had accomplished as worth all it paid him.

There is likely to be a difference between what a man accomplishes who believes in what he is doing to such a degree that he is willing to go hungry and almost naked in order to carry on his work, the man who will beg and borrow all the money he can possibly lay his hand on to keep going and the man who is secure on the payroll of a large corporation, has his work planned for him to a considerable degree and does not have to give too much thought and worry to the future. For this reason those, who are willing to risk everything they have, may accomplish results which never would be by those who are risking little or nothing, who may have temperaments which do not permit them to risk much.

Therefore, if there are to be changes in our patent laws, it would seem desirable to give these little fellows more, rather than less protection. There are times when the little fellow is forced right out of the picture without much reward for what he has done. This may happen in a new industry more often than in older ones. Because there is so little known about the industry, the rights granted under a patent may not be as clear as in the case of a new industry. Besides, the rate at which new information is gained is more rapid. A man starts a small enterprise in this new industry. He has his own patents. The time comes, however, when there are one or more large corporations formed to do business in that industry.

This pioneer finds himself in a position where he must fight patent infringements in order to have the rights under the patents clarified in the courts. He may have to sue the big corporation or it may sue him. In either case, he has to have ample financial backing to conduct these suits. The great corporation has that backing. The little fellow does not. He has no choice. Not only does he have to sell to the large corporation but he has to accept the price offered him. It may be liberal. On the other hand it may not. It would be fine if there was some way to permit this man to continue in business without the necessity of fighting patent infringement suits.

There are 32 thousand or more people working at organized research but there are millions doing more or less unorganized research. Organized research is profitable for the simple reason it is organized and planned. Unorganized research is a gamble. Some win. Some lose. All have a grand and glorious time and it would be sad, if not disastrous, to make the odds against the unorganized research worker any greater than they are.—J. E. BULLARD.

BOOK REVIEW

How to Make and Use a Small Chemical Laboratory, *by Raymond Francis Yates. New Revised and Enlarged Edition by S. A. Pellerano.* 140 *pages. Norman W. Henley Publishing Company, 2 West 45th Street, New York, N. Y. Price* $1.00.

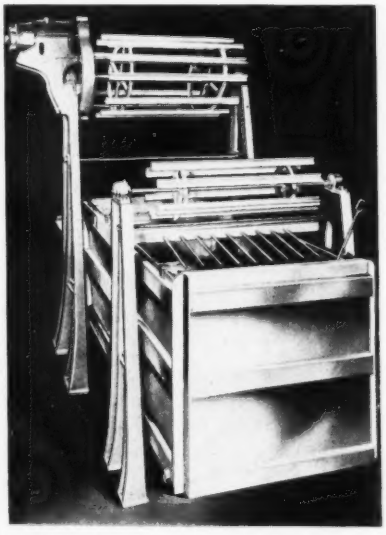
This book is fundamentally for those who have never studied chemistry, and wish to obtain an insight into the subject in a comparatively short time. It gives the basic information for an understanding of the fundamentals of chemistry, and should prove an inspiration to study further into this fascinating and far-reaching realm of science. Many experiments are described which might well be carried out in a home laboratory. To attempt to cover so broad a subject in so few pages has certainly been a daring undertaking, but the book is well written and will undoubtedly serve the purpose of indicating to the reader whether he is sufficiently interested in chemistry to pursue further study.

TRADE NOTES • NEW PRODUCTS

• FINE CHEMICALS BOOKLET

An attractively illustrated book on "Fine Chemicals"—the term for 63 organic chemicals recently added to those already industrially available—has just been published by Carbide and Carbon Chemicals Corporation. The chemical industry is offered a well-balanced array of commercial synthetic organic chemicals—including now a wide choice of chemicals in each major organic family. In addition, a glimpse of the future is given by listing many "research" products, samples of which can be supplied on request.

Complete tables of physical properties are included in the new book, enabling the chemist to tell rapidly the boiling points, water solubilities, flash points, and other necessary characteristics of these "Fine Chemicals." The newly available properties obtainable in the new products, in terms of evaporation rates, water solubilities, oil solubilities, and boiling points, are claimed to be very desirable in certain processes. This book gathers together for the first time descriptions of these "Fine Chemicals" and condenses into a handy reference source many facts hitherto unpublished.



Copies of the book can be obtained from Carbide and Carbon Chemicals Corporation, 30 East 42nd Street, New York, N. Y.

• BUTTERWORTH DYE BECK

H. W. Butterworth Sons Co., Philadelphia, Pa., are now producing an all stainless steel dye beck available in all standard tub sizes. Specifications include: all welded stainless steel tub, ruggedly braced, equipped with removable perforated dye partition—6" outlet (2 furnished in 10 ft. width and over), welded in stainless steel steam pipes; oval and idler reel equipped with special "M" lags, all welded construction, reels mounted in self-aligning ball and roller bearings; stainless steel pin rails; cast iron side frames for both oval and idler reels, fully enclosed gear motor driving oval reel through cut gears, enclosed in cast iron guard.

• ROHM & HAAS RELEASE

Rohm & Haas Co., Inc., *222* West Washington Square, Philadelphia, Pa., has recently released the fourth in a series of circulars describing the RHoplex Resins. The series presents a discussion of the outstanding properties of these aqueous dispersions and suggestions for their application to textiles. Previous folders were entitled: No. 1—RHoplex Resins are Clear as Crystal; No. 2—RHoplex Resins are Tough; No. 3—RHoplex Resins are Shatterproof. Copies are available upon request.

• CIBA REVIEW

Ciba Review, Number 26, for October, 1939, has recently been issued. Featured in this issue is: "Medieval Cloth Printing in Europe." Contents are described by the following titles: The Earliest Specimens of Cloth Printing; Medieval Cloth Printing in Europe; The Technique of Early Cloth Printing; Textile Printing up to the Year 1500; Historical Gleanings; Scientific Notes. *Ciba Review* is a publication of the Society of Chemical Industry in Basle, represented by the Ciba Company, Inc.

• ANNUAL MEETING, U.S.I.T.R.

The 10th Annual Meeting of the U. S. Institute for Textile Research, Inc., will be held at the Pennsylvania Hotel, New York City on November 2nd, 1939. The program is as follows: 11 A.M.—annual meeting of members for presentation of reports and election of directors; 12 NOON—meeting of directors for election of officers, executive committee, etc.; 12:30 P.M.—luncheon meeting, open to members and guests, followed by a brief speaking program; 2 P.M.—open conference on "Wool Processing in the Light of New Knowledge of the Chemical and Physical Properties of Wool." President E. H. Killheffer will present his annual address following the luncheon. The open conference will be presided over by W. D. Appel. Committees for the annual meeting are as follows: Committee on Meeting—Ephraim Freedman, chairman, A. M. Tenney, D. G. Woolf, C. H. Clark; Committee on Nominations—Arthur Besse, chairman, F. S. Blanchard, Dr. A. C. Walker, D. G. Woolf; Budget Committee—Dr. E. H. Killheffer, chairman, E. N. Hood, C. H. Clark.

• QUARTERLY PRICE LIST

The Quarterly Price List of the R & H Chemicals Dept., E. I. duPont deNemours & Co., Inc., for October 1939, has recently been released. Copies are available upon request.

• NYLON HOSIERY ON SALE

Women's full-fashioned hosiery made of nylon yarn, the new textile fiber, was placed on sale in several Wilmington, Del., retail stores on Tuesday, October 24, the du Pont Company recently announced. It was the first public sale of nylon hosiery.

For the present, the Company stated, the sale will be restricted to Wilmington, because of the extremely small supply of nylon available from the experimental pilot plant here. It will be preliminary to nation-wide introduction in 1940 by hosiery manufacturers.

"From the Company's viewpoint," the announcement said, "the over-the-counter sales to the public will culminate extensive experimental work in cooperation with the hosiery industry. Several grades of quality hose have been developed. Emphasis has been on producing a serviceable stocking that has both sheerness and beauty."

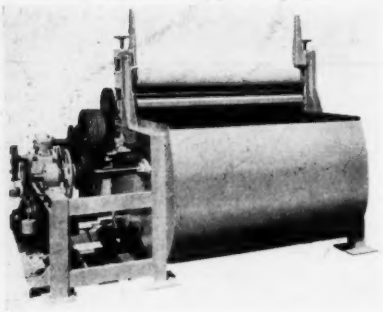
The limited sale puts the new hosiery to the test of practical use and permits impartial judgment of its merits. Three types of hosiery are offered. The 45 gauge hose sells for $1.15 a pair; the 48 gauge for $1.25; and the 51 gauge for $1.35. Sales are confined to three pairs to a customer and to people living in the Wilmington shopping area.

The stockings carry no brand names and are marked nylon.

• DYEING AND PROCESSING MACHINE

The new Duo Dyeing and Processing Machine is said to present many features which are quite revolutionary in character from the standard method of jig operation in the dyeing and processing of pieces goods. This machine is the result of four to five years of intensive research and work on experimental machines by men familiar with the practical handling of piece goods.

The Duo consists of two separate boxes, having a pair of controlled pressure rollers placed over the dividing partition. The cloth is wound upon beam rolls that are



placed within the boxes in such a position that the roll of goods can be batched totally submerged, semi-submerged or completely out of the liquor. The machine is motor driven with the squeeze rollers pulling the cloth from box to box with controlled tension at a constant speed of 100 yards a minute.

The manufacturers of the Duo recommend that the cloth be run in the submerged or semi-submerged condition for desizing, scouring, bleaching, washing, soaping and stripping. They recommend that for ordinary dyeing processes the dye liquor be maintained at such a level that the cloth can be wound upon the beam roll completely above the surface of the liquid. In this way the combined volume of the two boxes does not exceed the total volume of an ordinary jig and as can be readily recognized, one run on the Duo is equivalent to two runs on a jig. Furthermore, due to the fact that the pull on the goods is at a constant speed from the squeeze rollers rather than from the outside of the roll of cloth on the jig beam, the cloth batches in a straight even roll. This feature is said to minimize oxidized selvages in the dyeing of vat and sulfur colors.

It is stated that the constant speed of 100 yards a minute coupled with the action of the squeeze rolls on each run, plus controlled tension, produces even running of the cloth that will show greatly improved results in penetration, cross and lengthwise shading and practically eliminates all selvage difficulties.

Those finishers who have installed Duos report that they obtain more than double the production of a regular jig, with greatly improved quality of work and lower operating costs.

The essential features of the Duo Dyeing and Processing Machine are fully covered by patents. It is manufactured by the Duo Dyeing Machine Co., Charlotte, N. C.

• INSTALL TINTINOL PROCESS

The Erlanger Cotton Mills in Lexington, N. C., have installed the "Tintinol Process" for tinting rayon, put out by the Borne Scrymser Company. This mill has also equipped their cotton blending system with the Borne Scrymser Company's latest oil spraying device.

• NEW RAYON YARN

A new rayon yarn, "tailor-made" for the girdle and corset trade, has been announced by the Imperial Rayon Corporation.

The result of an intensive study of the requirements of elastic weaves in which rubber yarn is incorporated, the new product is spun from a solution of which the dye is an integral part.

"This new yarn has been produced especially for weaving into elastic fabrics," says P. E. Harrison, vice-president and general manager of the firm. "Remarkable strength is combined with really unusual softness, but it is the yarn's extremely high tenacity and elasticity which adopt it most strongly to weaving of this type."

• 1940 SPRING WOOLEN COLORS

The Spring 1940 woolen shades has just been issued by the Textile Color Card Association to its members. In addition to very new and interesting looking colors in the basic group for town wear, special significance is attached to the two featured collections, *Skytones* and *Playtones*. Because the emphasis on colorful play clothes for resort and country wear is stronger than ever, these refreshing sports shades are expected to score a big success at America's smart winter playgrounds in California and the South. The collection of sixty woolen colors was sent out to the Association's membership in confidential advance swatch form. The 1940 *Spring Woolen Card* portraying the same colors is now in preparation and will be issued to members shortly.

• SOUTHERN TESTING HOUSE MOVES

The Southern Testing House of the United States Testing Company is now located at new and larger headquarters—1200 Arlington Street, Greensboro, N. C. The new laboratories will be established with sufficient floor space to handle transit shipments of yarn and, at the same time, special laboratories have been built to handle a great variety of physical and chemical tests on fabrics and hosiery now being received at the Southern Testing House.

The Southern Testing House is now open for inspection and all visitors are welcome.

• CATALOG OF TECHNICAL BOOKS

A new large catalog of technical books has just been issued by the Chemical Publishing Co., Inc., New York City. It covers domestic and imported books on chemistry, physics, mathematics, medicine, metallurgy, machinery, engineering, biology, general science, business, manufacturing, and technical dictionaries. A copy will be sent to anyone interested, on receipt of stamps to cover postage.

• CIBA RELEASES

The following publications have been issued by the Ciba Company, Inc., representing the Society of Chemical Industry in Basle, announcing new products and processes.

Hosiery Shades on Spun Viscose Rayon with Acetate Rayon Effects—this card shows 27 types of dyestuffs and a number of combinations on spun rayon with acetate effects. Directions for preparatory treatment, dyeing and the production of a soft handle are given in the card. Sample Card No. 1698.

Sapamine KW, Application in Screen Printing—this card shows screen prints of Neolan colors on natural silk, which have been treated with Sapamine KW after printing, steaming and washing. By this after-treatment the possibility of the printed color bleeding into the white ground is said to be prevented while the goods lie in a damp condition. A further advantage of this after-treatment is the improvement of the fastness to perspiration. Sample Card No. 1705.

Half Wool Fast Dark Blue CB and CR, Half Wool Fast Black ASRG—this card shows new dyestuffs which are suited for the one-bath dyeing of fabrics made of wool and cut staple fiber or wool and cotton. Both the Half Wool Fast Dark Blue types are said to give direct dyeings of navy blue shades with very good wet pressing and perspiration fastness and good fastness to light. Acetate rayon effects are reserved: the same is true of the greenish toned Half Wool Fast Black ASRG. All three products are recommended for the dyeing of mixed fabrics for men's and women's wear. Sample Card No. 1717.

Direct and Acid Dyestuffs on Half Wool—this card shows a number of mixed fabrics with the dyestuffs that come into question in the dyeing of them, such as Direct, Chlorantine Fast, Diazo Fast and the neutral dyeing acid and Cloth Fast colors. The Direct and Chlorantine Fast dyes, which exhaust well at higher temperatures and on account of the presence of Albatex WS, reserve the wool, are also suited for the covering of the vegetable fibers in fabrics which have already been dyed in acid baths and also for the production of two color effects. Rosanthrene and Diazo colors come into consideration for such mixed fabrics, since they afford better resistance toward perspiration and washing. The products are applied by both the one-bath and two-bath processes. Sample Card No. 1720.